

TEXAS AGRICULTURAL EXPERIMENT STATION.

BULLETIN No. 36.

AUGUST, 1895.

VEGETABLES:

VARIETIES OF

SWEET POTATOES, ONIONS, MELONS, CELERY, BEANS,
CABBAGE, CAULIFLOWER, AND
TOMATOES.

INSECTICIDES.

POSTOFFICE:

COLLEGE STATION, BRAZOS CO., TEXAS.

All Reports from this Station are sent free to farmers of the State on application to
J. H. CONNELL, DIRECTOR, P. O. College Station, Texas.



AUSTIN:

BEN C. JONES & CO., STATE PRINTERS.

1895

[607]

TEXAS AGRICULTURAL EXPERIMENT STATION.

OFFICERS.

GOVERNING BOARD.

BOARD OF DIRECTORS A. & M. COLLEGE.

MAJ. A. J. ROSE, President Austin.
HON. W. R. CAVITT..... Bryan.
HON. D. A. PAULUS Hallettsville.
HON. G. W. BOWMAN Plano.
HON. JOHN B. LONG..... Rusk.

TREASURER.

PRESIDENT L. S. ROSS College Station.

STATION STAFF.

J. H. CONNELL, M. SC..... Director.
H. H. HARRINGTON, M. SC..... Chemist.
M. FRANCIS, D. V. M..... Veterinarian.
R. H. PRICE, B. S..... Horticulturist.
JAS. CLAYTON Agriculturist.
D. ADRIANCE, M. S..... Meteorologist, Associate Chemist.
P. S. TILSON, M. S..... Assistant in Chemistry.
J. W. CARSON, B. S..... Assistant to Director.
A. M. SOULE, B. S. A..... Assistant Agriculturist.

SUB-STATION SUPERINTENDENT.

S. A. MCHENRY..... Beeville, Bee Co.

TEXAS AGRICULTURAL EXPERIMENT STATION.

SWEET POTATOES, ONIONS, MELONS, CELERY, BEANS, CABBAGE, CAULIFLOWER AND TOMATOES.

The experiments reported upon in the following pages include a wide range of vegetable work, treating of the selection of best varieties, growing young plants, transplanting, and the protection of crops against insect enemies and fungus diseases. These experiments were undertaken because of the growing importance of truck farming in the State, and at the suggestion of many farmers who desire to grow the best varieties of vegetables. Many of our experiments with vegetables have covered the past three years, but some of the statements made in this Bulletin are drawn from the past seven years experimental work. In beginning the work with vegetables here, it was hoped that a Bulletin would be published on each class of vegetables, but, owing to the pressure of work, it was concluded to publish all the results in a condensed form in one Bulletin.

SWEET POTATOES.

R. H. PRICE, B. S.

According to the census report of the United States for 1890, Texas ranks third in sweet potato culture. The number of bushels grown in the State that year was 5,505,452. The value at 50 cents per bushel is \$2,752,726. This does not include the value of the tops and vines, which are sometimes fed to stock in September and October.

Our work with sweet potatoes was very much enlarged during 1894. It will be seen from the table which follows that there were fifty varieties in the test, besides three synonyms. The work with these, as announced in Bulletin No. 32, embraced cultural methods, methods of propagation, chemical analyses after storage, fertilizer work, and comparative productiveness of the varieties.

VARIETIES.

The season of 1894 was very favorable, and consequently some of the varieties made enormous yields. The average yield for two years, given in the table, may be considered most reliable for varieties grown on a soil similar to ours, because the time covered a dry and a wet season—extremes in both directions. The soil upon which the tests were made is a dark, sandy, compact clay of medium fertility, underlaid by an almost impervious white clay. Some of the varieties would have shown higher yields and better table quality, no doubt, if they had been grown on a sandy loam soil, which is considered the best.

After the ground was well prepared by plowing and harrowing, ridges were then thrown up, with a turning plow, four feet apart. A plank drag was then run over the ridges until they were leveled down to within four inches of the surface of the ground. This put the soil in fine condition for transplanting. Plants were set 14 inches apart in the rows, April 15th to 25th, both years. Each variety occupied a single row 50 feet long. Weeds were kept down by frequent shallow cultivation. When the last cultivation was given a sweep was used to throw some dirt up to the vines. It will be seen from the table that Gen. Grant made the largest yield for one year and that Shanghai made the largest yields for two years.

Table No. 1.

Name of Variety.	Character of Flesh when Baked.	Season.	Yield per Acre, in bushels.				Table quality, 0 to 10.
			Merchantable.	Culls.	Total.	Average Yield for two 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	7
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	7
Bronze	White, moist, sweet.....	Late.....	575.83	.....	575.83	.....	9
Bunch Yam.....	White, soft, sweet.....	Early.....	341.09	28.16	369.25	262.63	9
Canal	Pale yellow, mealy.....	Late.....	370.68	5.76	376.44	.....	7
Cavitt's Earliest	Light yellow, soft, moist	Early.....	303.98	3.88	306.88	.....	9
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	7
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.....	324.36	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	.....	614.35	.....	6
Gold Skin.....	Yellow, mealy.....	Early.....	101.70	11.90	113.60	77.13	9
Hall	Reddish yellow, soft, moist.....	Early.....	319.93	20.77	340.80	.....	7
Hayman	Pale yellow, soft.....	Medium	311.06	7.76	318.82	179.61	8
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	Reddish 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	Reddish, soft, wet.....	Late.....	101.43	6.75	108.18	.....	7
Padisha	Reddish, 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	Reddish 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	Reddish yellow, soft, wet.....	Late.....	300.76	10.37	311.13	.....	8
Shanghai (California).....	White, soft, damp.....	Medium	402.72	13.32	416.04	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
Tioteeta	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	95.30	85.26	8

YIELDS FROM LARGE AND SMALL POTATOES.

In the selection of seed, the sweet potato is frequently compared with the Irish potato, and it is therefore claimed that only good size, smooth tubers should be selected for seed. Botanically considered, the sweet potato differs very much from the Irish potato. In the first place, it has no distinct eyes, like the Irish potato, when first dug. It is simply a part of the root, while the Irish potato is a part of the stem, and the eyes more nearly represent true seed or buds. This fact may be a botanical reason why very large yields are often obtained from small sweet potato tubers and from vine cuttings, while large crops of Irish potatoes are not so apt to grow from small tubers. So far as our experiments go here, it seems safe to conclude that slips from very small tubers will grow as large potatoes as slips from large tubers; but it must be borne in mind that small tubers will not produce as great an amount of slips as large tubers will.

The test with different sizes of tubers was planted at the same time, upon the same kind of soil, in rows 50 feet long, and cultivated in the same way as the varietal test. The conditions for the vine cutting tests were also the same, except that they were planted June 16th.

Table No. 2.

	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

YIELD FROM VINE CUTTINGS.

Table No. 3.

	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
Ticoteta, yield from vine cuttings planted June 16th	44.45	.....	44.45

As a rule we have found that the heavy vine varieties, like Hall and Shanghai, start off quicker and grow better from vine cuttings than the small vine varieties, such as Tennessee and Yellow Yam. We have grown good potatoes from vine cuttings of the General Grant variety in seventy-five days. The tubers from these vine cuttings are usually much smoother than those from the slips. They are also much less liable to be diseased, and are therefore to be preferred for seed the following year. A few early plants should be set out to furnish vine cuttings. One

acre of early plants will produce enough vine cuttings for four other acres, if a vigorous growing variety be used.

DESCRIPTION OF VARIETIES NOT MENTIONED IN BULLETIN NO. 28.

Bronze.—Foliage dark purple; tubers oblong, dull straw color; table quality high; promising new variety. Originated in Kansas. Obtained from J. T. Lear, Shreveport, La.

Canal.—Vines purple, very strong and vigorous; tubers very large, oblong, smoother than Brazilian, which they somewhat resemble. Prof. F. H. Burnette, of Baton Rouge, La., obtained it from the Georgia Station. It came originally from Cuba.

Cavitt's Earliest.—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.

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. Obtained from J. T. Lear, Shreveport, La.

Cuban Yam.—Foliage light green, with purplish veins underneath; tubers large, roundish, white, resembling Hayti Spanish. Obtained from Maj. W. R. Cavitt, Bryan, Texas.

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. Perhaps same as Gen. Grant. Obtained from J. W. Steubenrauch, Mexia, Texas. Was named Florida Yam by Mr. Steubenrauch because he traced it back to Florida. He also informed me that it is sometimes called "Caddle Potato" in some parts of Georgia.

Gen. Grant.—Foliage light green, with purple veins on under side of foliage; tubers very large, oblong, white; a vigorous grower and heavy yielder; grows well from cuttings. Same as Florida Yam. Obtained of Julius Schnadelbach, Grand Bay, Ala.

Hall.—Foliage light green; tubers rather conical, light purple, grows vigorously and is a heavy yielder. Same as Nancy Hall. Obtained from A. J. Aldrich, Orlando, Florida, who states that it came up from a package of flower seed planted by Miss Hall, and hence its name.

Hayti Spanish.—Foliage light green, with purple veins on under side; tubers large, oblong and white; a vigorous grower and heavy yielder. Obtained from Dr. W. B. Morrow, Calvert, Texas.

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

Matejita.—Foliage dark green with purple veins; tubers rather oval, large, purple. A vigorous grower, but does not stand drouth well. Obtained of Professor F. H. Burnette, Baton Rouge, La.

Nancy Hall.—Same as Hall. Obtained from Julius Schnadelbach, Grand Bay, Ala.

Orange.—Foliage light green; tubers medium size, light purple, affected considerably by drouth. Obtained from Dr. W. B. Morrow, Calvert, Texas.

Padisha.—Foliage green; tubers resemble Pumpkin Yam in type, but the quality is much poorer; large, light red. Said to have originally come from Georgia. Obtained from Professor F. H. Burnette, Baton Rouge, La.

Peruvian Yam.—Foliage green; tubers resemble Hall, roundish, light purple, vigorous grower, has poor table quality. Obtained from Julius Schnadelbach, Grand Bay, Ala.

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

Providence.—Foliage green, with purple veins at base; tubers large, rather oblong, vigorous grower: said to have originated in Florida. Obtained from Professor F. H. Burnette, Baton Rouge, La.

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

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.

Strasburg.—Foliage green; tubers large, roundish, white. Stands drouth well, but has poor table quality. Obtained from Prof. Burnette, Baton Rouge, La. Resembles preceding variety.

Ticotea.—Foliage green with purple base; tubers rather small, oblong, white; not productive. Said to have come from Cuba. Obtained from Prof. Burnette, Baton Rouge, La.

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

THE VINELESS YAM.

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 been easily 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 Nansmonds of the North.

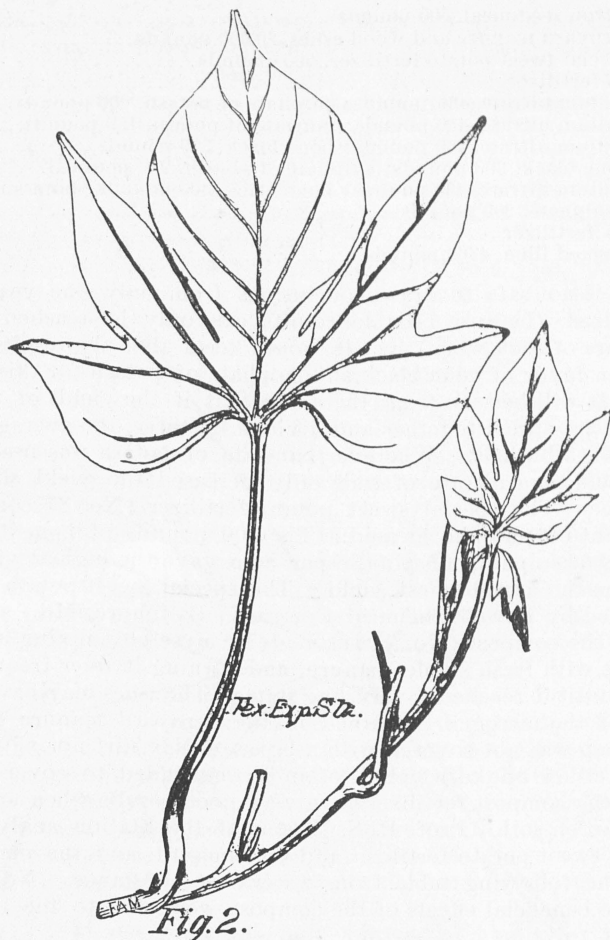
The Vineless was found growing among some hills of the Yellow Yam potatoe in Mississippi in 1884. Just how it originated is not known, neither have I been able to trace the origin of the two varieties from the Vineless with certainty, but all the evidence I have been able to collect

goes to prove that these varieties were found also near the time and place of the true Vineless. Perhaps we owe it to insects cutting off the vines or to the well known tendency of plants to produce variations or "sports," that this excellent variety has come into cultivation.



(One-half natural size.)

FIG. 1. This figure shows the arrangement of the leaf stalks on the vine of the Vineless variety.



(One-half natural size.)

FIG. 2. This figure shows the arrangement of the leaf stalks on the two variations from the Vineless variety.

APPLICATION OF FERTILIZERS.

The fertilizer work was carried on during 1894, and is being duplicated during 1895. The conditions were essentially the same as for the variety test. The latter part of the past season was very favorable to growth. The following is the number of the experiment, fertilizing materials used per acre, and calculated yield per acre in bushels:

Table No. 4.

	Yield in Bushels.
No. 1. Sodium nitrate, 460 pounds.....	128.33
No. 2. Muriate of potash, 150 pounds.....	146.47
No. 3. Bone black, 300 pounds.....	207.66
No. 4. Sulphate of potash, 200 pounds.....	208.79
No. 5. No fertilizer.....	201.17

No. 6.	Cotton seed meal, 500 pounds.....	194.67
No. 7.	Barnyard manure and wood ashes, 20,000 pounds.....	179.85
No. 8.	Special sweet potato fertilizer, 600 pounds.....	222.50
No. 9.	No fertilizer.....	219.71
No. 10.	Sodium nitrate, 460 pounds; sulphate of potash, 200 pounds....	166.87
No. 11.	Sodium nitrate, 460 pounds; muriate of potash, 150 pounds....	170.77
No. 12.	Sodium nitrate, 460 pounds; bone black, 300 pounds.....	208.76
No. 13.	Bone black, 300 pounds; sulphate of potash, 200 pounds.....	255.50
No. 14.	Sodium nitrate, 460 pounds; bone black, 300 pounds; potassium sulphate, 200 pounds.....	173.36
No. 15.	No fertilizer.....	170.58
No. 16.	Slacked lime, 4360 pounds.....	250.14

While it is not safe to draw conclusions from only one year's work with fertilizers (because reliable results can only be reached through several years of such work), yet it would seem that the results reached so far are in favor of bone black and sulphate of potash for this crop on this soil. It will be seen from the table that if the yields of the three check plots are added together and divided by three, the average for the three is 197.15 bushels. Wherever muriate of potash was used it lowered the yield, and nitrate of soda only increased the yield slightly in one instance. The special sweet potato fertilizer (No. 8) contained a high per cent of phosphoric acid. The 300 pounds of bone black and 200 pounds of sulphate of potash per acre gave the highest yield, and slacked lime the next highest yield. The special sweet potato fertilizer was prepared by Powell Chemical Company, Baltimore, Md., at our request, and the compost (No. 7) was made by myself by mixing unleached wood ashes with fresh stable manure, and turning it over frequently at intervals, until it reached a very fine state. The ashes may have driven off some of the nitrogen contained in the barnyard manure when the oempost heap was not covered with a layer of clay dirt nor with plaster (gypsum), either one of which is often recommended to cover compost heaps, yet the compost fertilizer gave very good results when applied on common garden soil. Prof. P. S. Tilson of the Station analyzed both the special sweet potato fertilizer and the compost, and the analyses are given in the following table from water free substance. No doubt a part of the beneficial effects of the compost were due to the lime contained in it.

Table No. 5.

	Special sweet potato fertilizer.	Compost.
Total phosphoric acid.....	8.50 per cent	0.86 per cent
Potash.....	1.93 per cent	1.42 per cent
Total nitrogen.....	0.80 per cent	0.57 per cent

SWEET POTATO TEST AT HULEN, GALVESTON COUNTY.

The following is a report by Prof. Fred W. Mally upon eight varieties tested for us on a rather light sandy-loam soil:

“Slips of eight varieties were received May 3, 1894, as follows: Southern Queen, Gen. Grant, Gold Skin, Vineless, Tennessee, Nansemond, Pool's Yam and Red Burmuda. A severe drouth had prevailed for nearly a month previous to receiving the slips, but fortunately a rain just pre-

ceded their arrival, permitting their being transplanted. The drouth, however, continued until the latter part of July, and then excessive and continued rains followed until October. Hence the normal results were greatly vitiated in the matter of the test in progress; though they might yet have been approximately normal had not the excessive rainy season been again followed by a season of drouth until December. The tabulated record of yields is therefore only a comparative study relative to the varieties, and not the actual productive value of the several varieties under reasonable circumstances.

“From the appended table it will readily be seen that some varieties take more readily during a dry spell at planting time than do other varieties. In this list Tennessee, Pool’s Yam, and Gold Skin do not take readily with insufficient moisture in the soil. This result is indicated in the table by the number of hills dug and examined.

“The same table shows that the following kinds rotted badly under the conditions of excessive rains: Nansemond, Vineless, Southern Queen, and Gen. Grant. Those rotting but slightly are Gold Skin and Tennessee, while Pool’s Yam and Red Bermuda seem to have withstood this feature of the test very satisfactorily.

“The possible productiveness of the several varieties, as indicated by the average number of potatoes started in the hills, under the desperate conditions mentioned, places Gold Skin, Vineless, and Southern Queen in the lead in the order mentioned, while Tennessee, Gen. Grant, and Nansemond are about at par with each other, though decidedly in second place.

“It is very evident from the table, under the conditions mentioned, the plants of most of the varieties succeeded in doing little more than set the potatoes, but could not mature them so late in the season. The relative merits of the several varieties (except Red Bermuda and Pool’s Yam, which did not rot at all, and hence were probably not seriously checked in their development) are therefore probably indicated more accurately in the column noting the small potatoes. Upon this basis Gold Skin and Vineless are quite distinctly in the lead in the matter of productiveness.

“Owing to circumstances beyond control, no quality or keeping test could be made.”

Table No. 6.

Variety.	Number hills.	Number potatoes.	Small.	Medium.	Large.	Rotten.	Number per hill.	Per cent Saleable.*
Tennessee	8	45	40	4	1	1	5 1-2	11
Nansemond	25	130	110	4	4	12	5 1-5	6
Pool's Yam	14	32	23	.....	9	.....	2 1-3	28
Southern Queen	17	152	85	40	27	6	9	44
Gen. Grant	30	157	59	27	71	6	5 1-4	62
Gold Skin	14	157	107	31	19	2	11 1-4	31½
Vineless	26	273	178	70	25	24	10 1-2	35
Red Bermuda	42	196	113	37	46	.....	4 2-3	42

*Includes medium sized and large.

TRANSPLANTING.

It is frequently the practice of growers to transplant when the ground is very wet. This is not at all necessary. If the slips or vines be set when the ground is in such condition, it becomes very hard around the plants when dry, and thus checks the early growth. The ground is moist enough when in good working condition. The main points to be remembered are to have the soil well prepared, set the plants on a cloudy day or late in the afternoon, and press the dirt firmly around the roots. The cost of transplanting is usually expensive. When done with a dibble or stick by hand, it is hard work. We have been experimenting along this line to lessen the cost and lighten the labor.

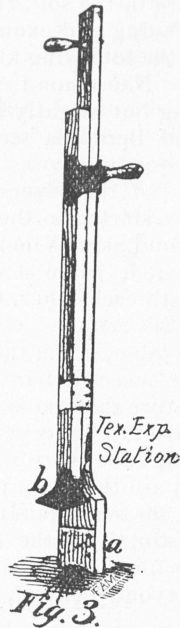


FIG. NO. 3.—*Sweet Potato Transplanter.* a, *The paddle which pushes the plant down.* b, *The foot which presses the dirt around the roots.*

In figure No. 3 is shown a sweet potato transplanter, bought of Mr. J. W. Parker, Paulsboro, N. J., and sold for \$1.50. This machine consists of two wooden strips which slide up and down and are held together by tin cross bands. The one with a paddle on end pushes 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 be in good condition this machine will put the plants in the ground as fast as one man drops them. The plants are dropped along the row with the roots towards the transplanter. There is a rubber on the end of the paddle to prevent the machine from cutting the plants while they are being pushed into the ground. The machine may also be used in planting vine cuttings.

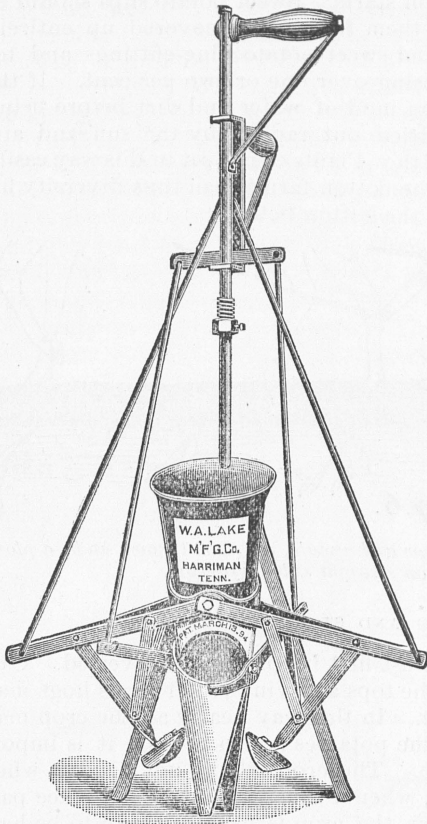


FIG. NO. 4.—Peerless Plant Setter.

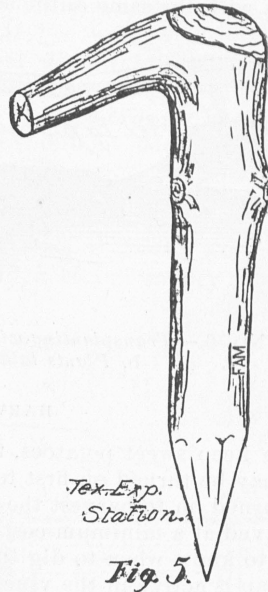


Fig. 5.

FIG. 5.—Showing Convenience of Ordinary "Dibble."

In figure No. 4 a cut is shown of "The Peerless Plant Setter," bought of W. A. Lake Manufacturing Co., Harriman, Tenn., which costs \$6. This machine does well with small plants, but large plants do not slip through the chute so easily. It is better adapted to transplanting such plants as tomatoes and cabbage than sweet potatoes. To use either of the above machines successfully the ground must be in good condition. They won't work when the ground is hard and cloddy.

In using any complicated or delicate machinery, the Southern horticulturist or agriculturist is confronted with the difficulty of teaching the ready but unskilled negro how to use these labor-saving implements. Realizing this difficulty, we have sought to overcome it by using to a large extent the same farming outfit we find in the cotton fields. The negro, the mule, and the one horse turning plow work together smoothly. After a furrow is thrown open by this plow, the plants are dropped along the straight side of the furrow every one or two feet while the furrow is fresh. The dirt is then thrown back on the plants as shown in figure No. 6. If a man walks on the dirt just above the plants or vines after the dirt has been thrown on, and presses it firmly around

the roots of the plants, growth soon starts. Sweet potato slips should of course be of good length, to keep them from being covered up entirely by the plow. We have transplanted sweet potato vine-cuttings and tomato plants in this way without losing over one or two per cent. If the roots of plants be puddled in a thin mud of water and dirt before being set, it prevents them from being dried out rapidly by the sun and air, and increases their chances of growth. Plants can be set in this way easily at a cost of about \$1 per acre. The cotton farmer can thus diversify his crops with the same outfit used in the cotton field.

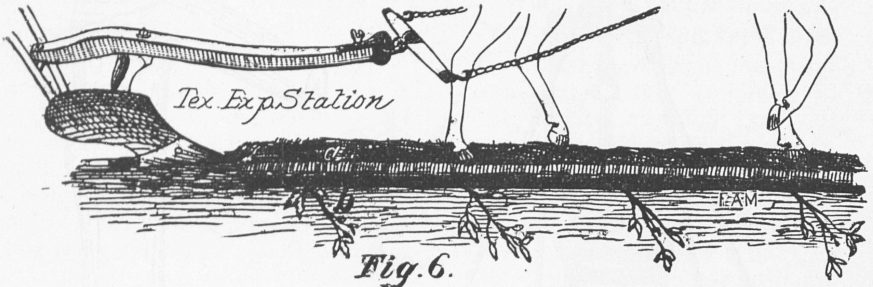


FIG. NO. 6.—Transplanting with a plow and a mule. a, Dirt thrown up by a plow. b, Plants laid along on straight side of furrow.

HARVESTING AND STORING.

To keep sweet potatoes, they must first be properly harvested. Cattle may be turned on first to eat the tops and vines, 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 potatoes are to be dug, it is important to know when to dig the crop. The crop should not be dug when the sap is active in the vines. If, when a tuber is cut, the cut place partially heals over and becomes dry, the crop is usually ready to be harvested. But if the cut place turns greenish black, the crop is not ready to be harvested.

Vines are a great nuisance in harvesting sweet potatoes. We have used a sharp rolling coulter on the beam of a turning plow just in front of the point successfully. This rolling coulter cuts the vines on each side of the row, while some dirt is thrown away from the row at the same time. The third time the turning plow is run in the center of the row and the potatoes thrown out. The tubers are then gathered and sacked. Care must be taken not to bruise them, as the "soft rot" is apt to start at all bruised places. All bruised tubers should be sorted out at once and fed before storing. We have tried "Fostite," Bordeaux mixture, lime and sand in keeping sweet potatoes, but neither one proved effectual in preventing the spread of black rot. We have obtained good results by letting the tubers remain in the ground where they grew until wanted. Throwing dirt over them with a turning plow will prevent freezing. Further work, which is now in progress, is necessary along this line before positive recommendations can be given as to the best method to prevent injury by black rot. If the potatoes are to be stored away, they must be dried out first, and those which decay from soft rot must be taken out frequently. In about two weeks after digging they will be

dry, and the soft rot will stop. A cut of the potato house we have used in keeping potatoes, both sweet and Irish, is shown in figure No. 7. 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 side of the posts, thus forming a long box. The potatoes are stored in these, and dry road sand mixed with them. Mice can not go through dry sand. Potatoes kept well in this house last winter (1894-1895) when the temperature went down as low as 7 degrees Fahrenheit, 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 diseases which will infect the next crop when stored. Where we did not change the sand nearly all the crop was lost from black rot. The potatoes that have kept best are the Brazilian, Canal, Shanghai, and Southern Queen. The purple skin varieties have resisted the disease best. We have failed in trying to keep the vines over winter when stored in dry sand and when buried out in the ground.

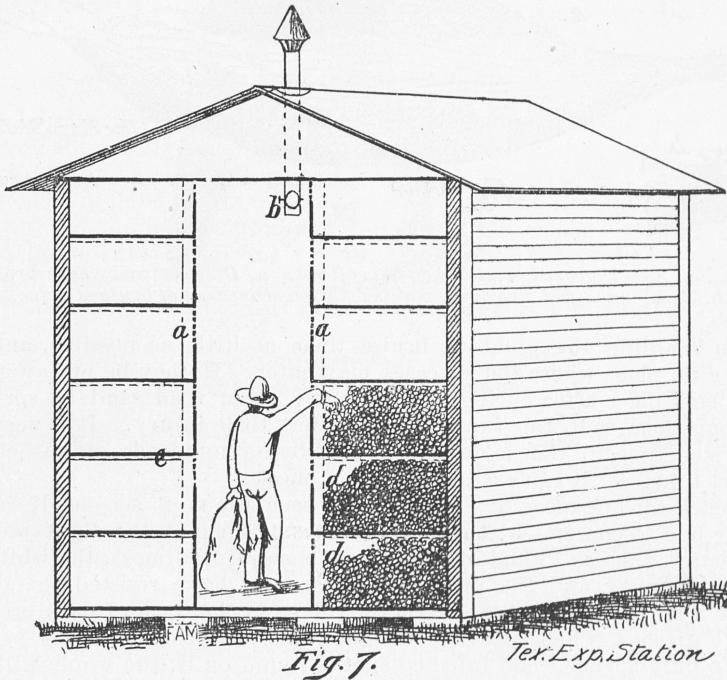


FIG. NO. 7.—a, Posts which go up through the center from floor to ceiling. b, Ventilator which may be opened in warm weather and closed in cold. c, Double wall. d, Potatoes stored in sand. e, Cross-pieces which run from posts to wall.

FUNGUS DISEASES OF THE SWEET POTATO.

There are several fungus diseases which live upon the sweet potato and produce the condition known as rot. Only those which have been the most destructive here will be discussed. Perhaps the most serious one the grower has to deal with is the soft rot (*Rhizopus nigricans*). This fungus is not found in abundance in the field, but does the most serious work in the store room. The potato when attacked at once becomes soft and worthless, and gives off an offensive odor. Mycelium (or mould) soon grows over the tuber in a white felt-like mass. The tuber then begins to shrink, and at the end or bruised places will appear a dark powdery mass of spores, as shown in figure No. 8. The fungus does its most serious work soon after digging, while the potatoes are going through a sweat. The tubers should be placed in small piles in a dry cool place, and be watched carefully until they are dried out. If the diseased ones are taken away and the potatoes are well cared for the fungus will almost stop in two weeks, when the tubers are ready for storing.

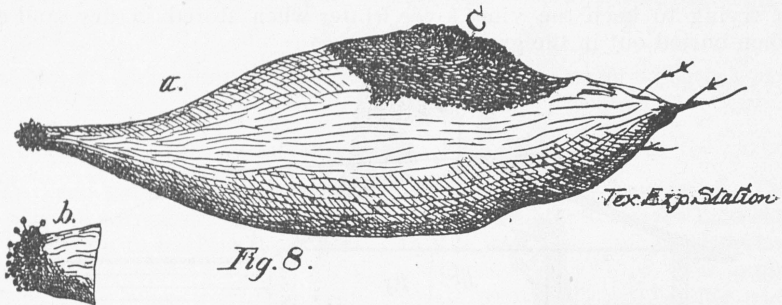


FIG. No. 8.—Diseased potato, showing soft rot. a, Diseased end where broken off. b, Same magnified, showing spore sacks. c, Diseased at bruised place.

In handling the potatoes, bruise them as little as possible, and thus leave no place where the diseases may enter. If they be put away in a dry cool place after curing out, and dry clean road sand be sprinkled among them well, this fungus will do but little injury. It is very serious sometimes if this is neglected, destroying hundreds of bushels in a short time, yet it can easily be held in check.

Black rot (*Ceratocystis fimbriata*) has been the most serious disease we have had to contend with in the store room. All of the light red skin varieties, such as Pumpkin Yam, have been injured most, the white skin varieties next, and the purple skin varieties have resisted the disease best. This disease appears upon the tubers in the form of dark brown or olive patches, which are very irregular in outline. If a tuber be eaten when only a very small infected spot is found on it, the whole will have an unpleasant bitter taste. Some have attributed this bitter taste of the tubers to freezing, which is a mistake. We have had several of these diseases in the laboratory at once, and have been studying them under a microscope during the past two years. Spores from diseased potatoes have been placed in sound potatoes and the disease produced, so there can be no doubt as to the cause. A tuber when infected with this dis-

ease becomes dry and inoffensive. It sometimes attacks young plants in the bed, producing what is known as "black shank." Diseased potatoes should never be bedded out to grow slips or sets from. Diseased slips should never be planted in the field. A field which has grown diseased sweet potatoes should not be used again for the same purpose for two or three years. As before stated, it is best to grow potatoes for seed from vine cuttings, because they are much less liable to carry diseases which will infect next year's crop.



FIG. NO. 9.—Black rot on sweet potato.

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.

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

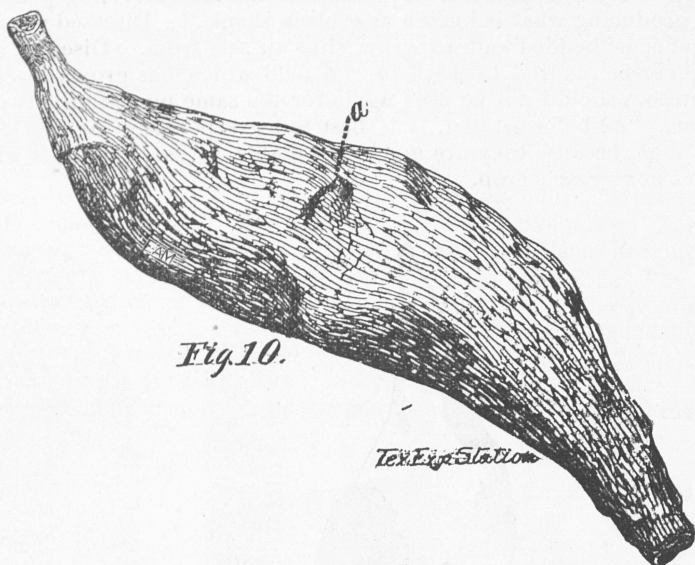


FIG. No. 10.—Shows the appearance of the potato that was infected with stem rot.
a, Cut place where the spores were put into the potato.

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.

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.

Sweet potato scurf (*Monilochaetes infuscans*) produces a dark, rusty, brownish coating, and frequently appears on the tubers when dug. The disease spreads some after the crop is dug. It causes the potatoes to shrivel, but does not injure them much for table use like the black rot does. Potatoes having this scurf on them should not of course be used for seed.

INSECT ENEMIES OF THE SWEET POTATO.

Injury by cut worms, flea beetles, tortoise beetles and saw flies can be prevented till the plants get a start by dipping them before they are planted in the following preparation: London purple, three ounces; lime, two pounds; and water, twenty-five gallons. We have dipped the plants in twenty-five gallons of Bordeaux mixture which contained three ounces of London purple, to prevent injury from both insects and fungus diseases, but the experiments have not gone far enough to enable us to give positive statements in regard to this treatment for diseases.

A new insect enemy, known as "Sweet Potato Root Borer" (*Cylas formicarius*), appeared along the coast of the State at Matagorda Island

some ten years ago, and is now making its way further up into the State. Last year we found a few in our tests here. Growers can not be too careful to destroy all infected potatoes by burning them, as this seems to be the only way of checking the insect. Potatoes should be examined carefully before being planted. Plant on different land each year. This insect, which is supposed to have come from Cuba, is of a black and red color, and in its full grown state resembles the common corn weevil in shape.

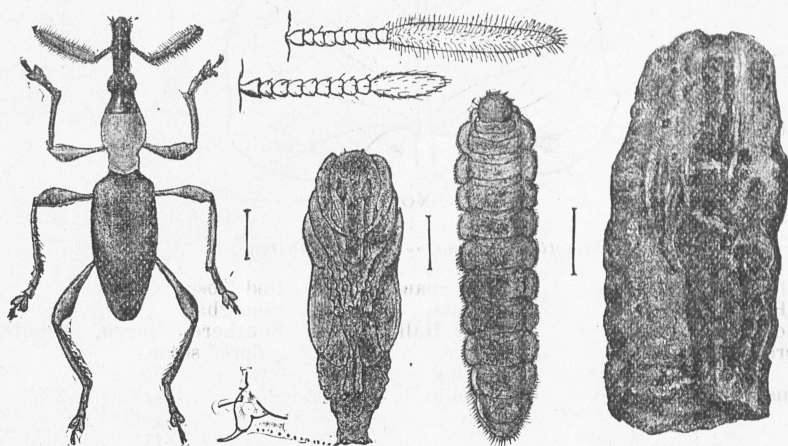


FIG. NO. 11.—*Sweet Potato Root Borer in all stages of growth, magnified.*

CLASSIFICATION AND DESCRIPTION.

In Bulletin No. 28 the varieties were divided into three classes. The classes were based upon the character of the foliage; the first included those with round or entire foliage, the second included those with shouldered foliage, and the third included those with lobed or split foliage. These classes included the three main divisions of sweet potatoes, as regards foliage. If the description of the foliage be taken in connection with a description of the tubers, there is scarcely a variety which may not be easily distinguished. The great number of local names which are given a variety in different localities where it may be cultivated is to be deplored, and should be discouraged by all who are interested in this most excellent vegetable for the South. At the head of each class occurs a figure illustrating the foliage of each.

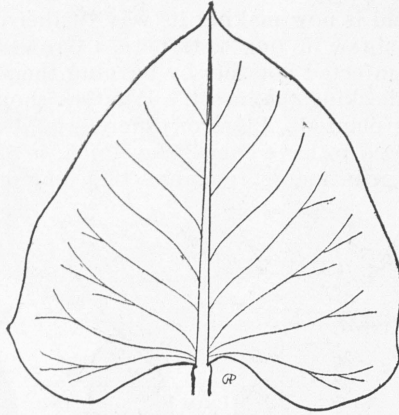


FIG. NO. 12.

Varieties with entire or round foliage.

Canal,
Dog River,
Florida Yam,
General Grant,
Hall,
Hayman, notched some,

Hayti Spanish,
Matejita,
Nancy Hall,
Orange,
Padisha,
Pumpkin,

Red Nose,
Shanghai,
Southern Queen, shouldered some.

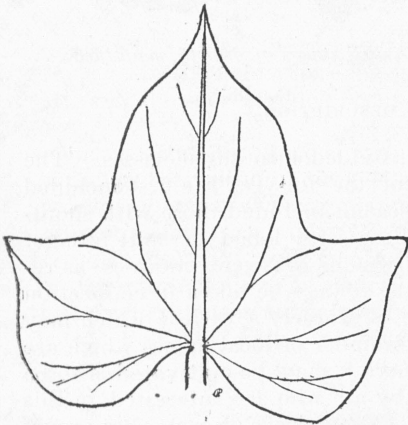


FIG. NO. 13.

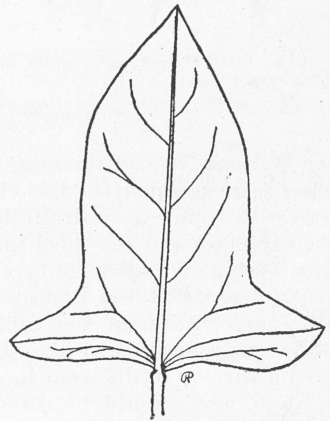


FIG. NO. 14.

Varieties with shouldered foliage.

Big Stem Jersey (Fig. 13), Early Golden (Fig. 13), Providence (Fig. 13),
Black Spanish (Fig. 14), Gold Skin (Fig. 13), Queen of the West (Fig. 13),
Brazilian (Fig. 14), Jersey Red (Fig. 14),
Bronze (Fig. 13), Nansemond (Fig. 13), Red Bermuda (Fig. 13),
Cavitt's Earliest (Fig. 13), Negro Choker (Fig. 13), Red Nansemond (Fig. 13),
Chinese 30 days (Fig. 13), New Jersey (Fig. 13), Strassburg, notched some (Fig. 13),
Cuban Yam (Fig. 13), Norton (Fig. 13),
Delaware (Fig. 13), Peabody (Fig. 13), White Brazilian (Fig. 13),
Extra Early Caroline (Fig. 13), Peruvian Yam (Fig. 13), Yellow Jersey (Fig. 13),
13), Pool's Yam (Fig. 13), Yel. Nansemond (Fig. 13).

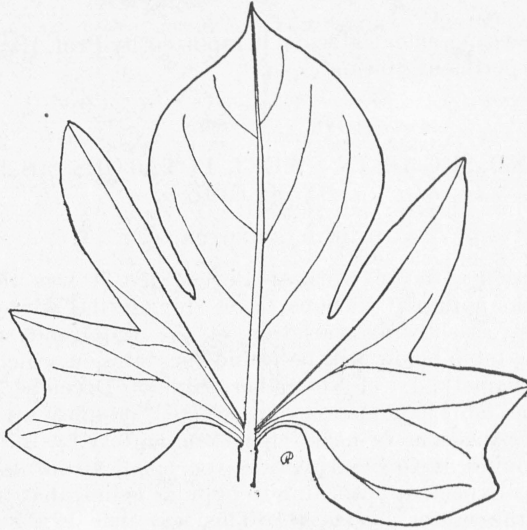


FIG. NO. 15.

Varieties with deeply cut or lobed foliage.

Georgia Yam,
Rockport,

Tennessee,
Ticotea,

Yellow Yam,
Vineless.

Varieties with white skin.

Barbadoes,
Cavitt's Earliest,
Cuban Yam,
Early Golden,
Florida Yam,
General Grant,
Georgia Yam,

Hayman,
Hayti Spanish,
Norton,
Pool's Yam,
Providence,
Rockport,
Southern Queen,

Shanghai,
Strasburg,
Tennessee,
Ticotea,
Vineless,
White Brazilian.

Varieties with dull straw colored skin.

Big Stem Jersey,
Orange,
Chinese 30 days,
Delaware,

Extra Early Caroline,
Gold Skin,
Nansemond,
New Jersey,

Queen of the West,
Red Nose,
Yellow Jersey,
Yellow Nansemond.

Varieties with light red skin.

Dog River,
Hall,
Nancy Hall,
Negro Choker,

Orange,
Padisha,
Peruvian Yam,

Pumpkin,
Red Bermuda,
Red Nansemond.

Varieties with purple skin.

Black Spanish,
Brazilian,

Canal,

Matejita.

After further study we fail to find any distinguishing characteristics between Negro Choker and Red Bermuda. They must be the same.

Many tubers from both weighed eight and nine pounds. Recommended for stock.

Some interesting chemical work is reported by Prof. Harrington, chemist of the Experiment Station:

WATER AND SUGAR IN SWEET POTATOES, AS INFLUENCED BY KEEPING.

H. H. HARRINGTON, M. S.

In connection with the work of Prof. Price, it was thought that an analysis of the potato at various times during the winter season would be of interest, as showing variation of the water and sugar contained. Stated in the table below will be found the dates on which these analyses were made, namely, 1st of November, 20th of December and the 6th of March. The table comprises some sixteen samples, although some of them may be the same or nearly the same variety.* 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 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 per centage 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.

As a feed potato for stock, it would be impossible to decide upon any one of these varieties from analyses which are shown in Bulletin No. 28, or from partial analyses presented in this Bulletin. This question will have to be determined by practical feeding tests taken together with analyses. But it is probable that there would be very little variation in this respect. We hope next winter to make a digestion test of some one of these varieties.

Prof. Duncan Adriance has carefully carried out the analytical data of the table of analyses.

*Bunch Yam, Early Bunch Yam and vineless are the same.—R. H. PRICE.

Table No. 6.

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	59.84	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	3.34	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

VARIETIES OF ONIONS.

R. H. PRICE, B. S.

During the past two years (1893-94) we have carried on experiments here in testing varieties of onions, as regards earliness, productiveness, and keeping qualities. Two methods of culture were also tried. It will be seen from the table that seven varieties produced at the rate of over 200 bushels per acre. Onions frequently retail in this State at \$1 per bushel. So it seems that growing onions from black seed is a paying industry. The inexperienced should not attempt it on a large scale at first. The soil upon which the test was made is the same as that described for sweet potatoes. The ground was given a dressing at the rate of ten tons per acre of well composted barn yard manure and wood ashes in the fall, and then thoroughly plowed and harrowed. A dressing of the same amount of the material was again put on in February, and the ground was again plowed, harrowed and run over with a plank drag. This work put the ground in excellent condition. The plank drag pressed it rather firmly, so that the seed drill would work well. This firming of the ground after plowing and harrowing is necessary so that the drill will run easily, the seed germinate well, and the bulbs form on top of the ground. The three main points of success are heavy manuring, thorough preparation of the ground, and good seed. The seed was sown on February 16, 1895, in rows 14 inches apart and 50 feet long for each variety. On March 1st the varieties were coming through the ground. The drill used was the Planet Jr. The same machine with the cultivator attachments was used afterwards in cultivating the onions. This machine can be bought of many seedsmen. The ground was kept well stirred after the plants came through till the bulbs began to form.

The following table gives season, color, size, keeping qualities, and productiveness of the varieties. The following abbreviations stand for seedmen of whom the varieties were purchased: "P. H. & Co.," Peter

Henderson & Co., New York City, N. Y.; "W. A. B. & Co.," W. Atlee Burpee & Co., Philadelphia, Pa.; "Liv.," A. W. Livingston's Sons, Columbus, Ohio; "G. T. & S.," George Tait & Sons, Norfolk, Va.; "T. S. & F. Co.," Texas Seed and Floral Co., Dallas, Texas.

Table No. 7.

VARIETIES OF ONIONS.

Name of Variety.	Seedsmen.	Color.	Size.	Season.	Keeping Quality.	Bushels—Calculated yield per acre.
Adriatic Barletta.....	P. H. & Co.....	White.....	Large.....	Early.....	Fair.....	94.60
Bermuda Red.....	Liv.....	Red.....	Small.....	Early.....	Good.....	233.33
Bermuda Island Red ...	Liv.....	White.....	Medium.....	Early.....	Fair.....	170.00
Bermuda Island White	Liv.....	White.....	Very large	Early.....	Poor.....	73.58
Creole or Southern.....	T. S. & Co.....	Yellow.....	Large.....	Early.....	Poor.....	163.33
Early Red Globe.....	Liv.....	Red.....	Large.....	Early.....	Poor.....	116.66
Early Neopolitian-						
Marzajola.....	Liv.....	White.....	Medium.....	Early.....	Fair.....	105.00
Early White Queen.....	G. T. & Co.....	White.....	Small.....	Early.....	Fair.....	118.10
El Paso.....	T. S. & Co.....	White.....	Very large	Early.....	.....	441.90
Extra Early Pearl.....	Liv.....	White.....	Large.....	Early.....	Good.....	46.66
Extra Early Flat Red.	P. H. & Co.....	Red.....	Medium.....	Early.....	Good.....	132.70
Extra Early Barletta..	W. A. B. & Co.	White.....	Small.....	Early.....	Poor.....	100.61
Extra Early Red.....	W. A. B. & Co.	Red.....	Medium.....	Early.....	Very good	144.36
Giant Rocca.....	G. T. & S.....	Red.....	Large.....	Medium	Very poor	211.10
Giant Yellow Rocca.....	Liv.....	Red-yellow	Large.....	Medium	Poor.....	131.08
Giant White Rocca.....	Liv.....	White.....	Medium.....	Late.....	Good.....	36.16
Giant White Tripoli.....	Liv.....	White.....	Large.....	Medium	Fair.....	19.16.
Giant Red Tripoli.....	Liv.....	Red.....	Medium.....	Medium	Poor.....	46.66
Giant White Garganus	P. H. & Co.....	White.....	Large.....	Medium	Poor.....	.....
Giant Yellow.....	W. A. B. & Co.	Yellow.....	Medium.....	Late.....	Poor.....	70.00
Giant Yellow Globe.....	P. S. Co.....	Yellow.....	Small.....	Medium	Poor.....	52.00
Giant White Italian.....	W. A. B. & Co.	White.....	Medium.....	Medium	Fair.....	19.00.
Large Red Globe.....	P. H. & Co.....	Red.....	Small.....	Late.....	Good.....	96.16
Large White Italian						
Tripoli.....	P. H. & Co.....	White.....	Medium.....	Medium	Poor.....	197.60.
Large Yellow.....	G. T. & Sons...	Light yellow...	Very small	Late.....	Very good	158.80
Mammoth Pompeii.....	P. H. & Co.....	Red.....	Large.....	Late.....	Good.....	225.00
Mammoth Red Tripoli	W. A. B. & Co.	Red.....	Medium.....	Late.....	Poor.....	17.50
Mammoth Silver King	Liv.....	White.....	Small.....	Late.....	Fair.....	261.00
New Mammoth Silver						
King.....	W. A. B. & Co.	White.....	Medium.....	Late.....	Fair.....	143.70
New Giant Red Rocca..	W. A. B. & Co.	Red.....	Very large	Late.....	Poor.....	70.00.
New Queen.....	W. A. B. & Co.	White.....	Small.....	Early.....	Fair.....	39.30
New Silver Ball.....	W. A. B. & Co.	Red.....	Large.....	Medium	Poor.....	163.33
New Opal.....						
Neopolitian-Marzajola	W. A. B. & Co.	Yellow.....	Medium.....	Early.....	Poor.....	87.50
Philadelphia Silver						
Skin.....	Liv.....	White.....	Very small	Late.....	Good.....	27.7
Philadelphia Strasburg	Liv.....	Yellow.....	Medium.....	Late.....	Good.....	62.7
Prize Taker.....	P. H. & Co.....	Red.....	Large.....	Medium	Very good	262.50
Queen.....	P. H. & Co.....	White.....	Large.....	Early.....	Fair.....	59.70
Red Bermuda.....	P. H. & Co.....	Yellowish Pur-	Small.....	Early.....	Poor.....	64.16
Red Globe.....	W. A. B. & Co.	Red.....	Medium.....	Medium	Fair.....	103.74
Red Italian Tripoli.....	P. H. & Co.....	Red.....	Medium.....	Medium	Poor.....	38.63
Red Victoria.....	W. A. B. & Co.	Red.....	Large.....	Medium	Fair.....	179.03
Round Yellow Danvers	P. H. & Co.....	Yellow.....	Small.....	Late.....	Good.....	185.83
Southport Yellow						
Globe.....	P. H. & Co.....	Yellow.....	Medium.....	Late.....	Good.....	105.00
Southport Large Yellow						
Globe.....	W. A. B. & Co.	Yellow.....	Small.....	Late.....	Good.....	4.03
Southport White Globe	P. H. & Co.....	White.....	Medium.....	Late.....	Fair.....	151.60
Silver Skin.....	G. T. & Sons...	White.....	Small.....	Late.....	Good.....	140.00
Silver White Etana.....	W. A. B. & Co.	White.....	Medium.....	Late.....	Fair.....	22.50
Strasburg.....	Liv.....	Yellow.....	Small.....	Late.....	Good.....	198.33
Wethersfield Large Red	P. H. & Co.....	Orange Red.....	Medium.....	Early.....	Fair.....	105.60
White Bermuda.....	P. H. & Co.....	Yellow.....	Small.....	Early.....	Fair.....	64.16
White Bunch.....	P. H. & Co.....	White.....	Small.....	Early.....	Poor.....	222.83
White Globe.....	Liv.....	White.....	Medium.....	Late.....	Fair.....	124.83
White Silver Skin.....	W. A. B. & Co.	White.....	Medium.....	Late.....	Poor.....	143.70
White Victoria.....	W. A. B. & Co.	White.....	Large.....	Late.....	Fair.....	191.03
Yellow Globe Danvers	P. H. & Co.....	Red.....	Medium.....	Late.....	Fair.....	167.50
Yellow Danvers Globe	Liv.....	Yellow.....	Small.....	Late.....	Fair.....	185.80
Yellow Danvers Flat...	Liv.....	Yellow.....	Large.....	Late.....	Good.....	128.50

Red Bermuda was the earliest variety in the list. It produced edible onions in 72 days from the time the seed was sown. It is a very small round red onion, and therefore not desirable for general crop. El Paso has made the largest yield, but has not been carried through the keeping test. This variety is early, a heavy yielder, and of very mild flavor. Judging from its record here so far, and from what I have learned about it from other places in the State, it is an onion of great promise. Prize Taker came out best in the keeping test. For this test the onions were placed in small boxes and stored in a loft where they had good ventilation.

TRANSPLANTING METHOD.

This method has gained great prominence in some Northern States. It undoubtedly is a good method as far South as Virginia, where I have tested it with favorable results for two years. After testing it here for two years, I conclude that it rarely pays, as is shown by the facts given in the following table. This method simply consists in growing the plants in a cold-frame or hot-bed and transplanting them like cabbage or tomato plants when they are as large as a small lead pencil.

The varieties for this test were sown in trays and placed in the hot-bed January 1, 1894. The plants were transplanted on the same day that the seed was sown in the field, February 16, 1894.

The following varieties given in the table were used in the transplanting test.

YIELDS FROM TRANSPLANTING METHOD.

TABLE NO. 8.—*Calculated yield in bushels per acre.*

	Bushels.
Large Red Globe	54.50
Giant Rocco	51.30
Prize Taker	125.50
Queen	75.00
Creole	73.80

The low yields obtained by the transplanting method are accounted for by the young plants being checked so much by transplanting that they did not mature their crop till the hot sun greatly injured them. The winters are seldom severe enough here to kill onions, and they usually make some growth all winter, even if planted in the fall. We have gathered nice green onions in January, the seed of which was sown early in September.

There is a way the transplanting method will pay even here, and that is by filling out the rows where the seed have failed to come. It is best to sow the seed rather thick, with the expectation of thinning out where they come too thickly and transplanting where not thick enough. The labor of transplanting onion plants in the ordinary way is very great. Following the same method mentioned for transplanting sweet potato slips, we have used a small hand plow in transplanting the onion plants very successfully. Furrows were made fifteen inches apart with a hand turning plow, and the onion plants placed along the straight side of the furrow every three or four inches and the dirt thrown back on them with the plow. Afterwards the dirt should be pressed upon the roots with the foot. The Planet Jr. drill with its cultivator attach-

ments can be used for this also. In Fig. No. 16 is shown a photograph of the Planet Jr. plow at work in our experiment transplanting onions. Care must be taken not to cover the plants too deep, as the bulbs should form above the ground. This method is original with me, as I have not seen an account of it given anywhere.

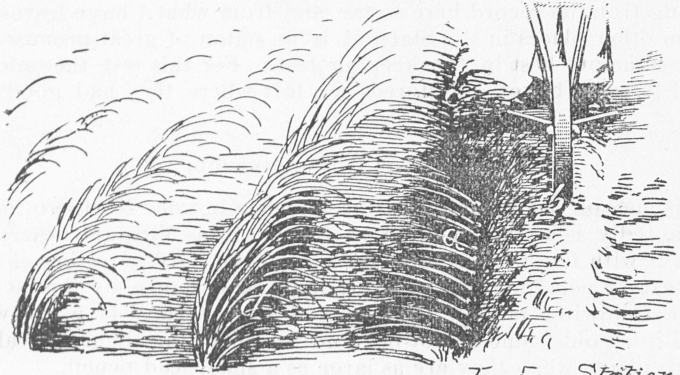


Fig. 16

Tex Exp Station

FIG. No. 16.—a, Young onion plants laid along the straight side of the furrow. b, Dirt before it is thrown back on the roots. c, Covered. d, Before thinning.

MUSKMELONS AND CANTELOPES—VARIETIES AND CULTURE.

R. H. PRICE, B. S.

Without entering into a botanical discussion of melons, it may be well to state here that nearly all muskmelons are known in many parts of the South as cantelopes. There are two main types which are cultivated. One, of which the Nutmeg is a type, is large, heavily netted, and deeply furrowed. The cavity is usually rather large, so that they are not the best for shipping. The flavor, while often very good, is not the best. The other type is small, heavily netted and only slightly ribbed, of which the Early Netted Gem is an example. The latter are sometimes known as the sugar melon, and the flavor is excellent. They stand shipment well. As a rule, it may be stated that those melons that are highly netted stand the hot sun better, are better shipping melons, and are of higher flavor.

Melons reach their highest development on a deep, mellow, sandy soil. The soil should be well prepared and the seed be planted as soon as danger of frost is over. In order to grow the crop early, which is a very important consideration from a commercial standpoint, it is best to make two plantings, one very early and the other some ten days later. Should the first planting be killed by frost or by insects, the second will usually make a stand. If neither planting be killed, the plants can be thinned out when the second pair of leaves have made some growth. We have planted seed in two inch rose pots which were placed in a hot-bed till the plants reached the proper size, and when danger from frost was over put them out in the fields. Plants started in this way have pro-

duced ripe melons one week earlier than seed planted in the fields. Parts of old tin cans may be used instead of pots. The cans may be thrown into the fire and the soldering which holds the ends and seams be melted, and afterwards the cans be rolled out so as to form a smooth cylinder. They do best if one be placed inside the other with the opening sides opposite, as shown in Fig. No. 17. After the plants are set out, one of these tin cans may also be used for a plant protector against cut worms and cold winds until the plant starts to run. The can is simply slipped up above the plant, with an inch of it remaining in the soil to hold it. The use of the cans to start the plants in was first suggested to us by Major Jno. Adriance, Columbia, Texas, by whom they have been used for a number of years.

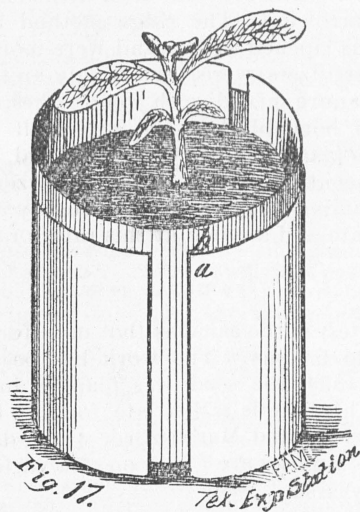


FIG. NO. 17.—a, Outside can. b, Inside can.

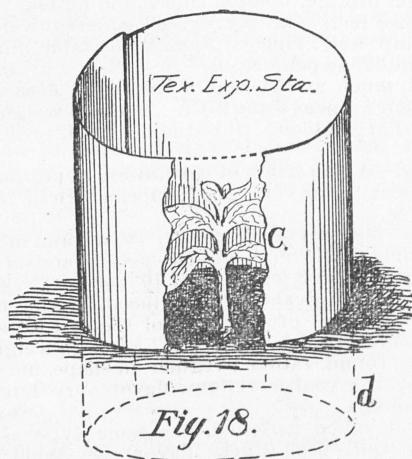


FIG. NO. 18.—c, Projection above ground. d, Projection below ground.

The small striped beetle (*Diobrotica vittata*) appeared on our young vines last year and threatened to do serious damage, but after spraying them well with Bordeaux mixture, into which had been stirred three ounces of London Purple to every twenty-five gallons, we had no further trouble. For the Melon Aphis, which does serious injury to vines in some parts of the State, kerosene emulsion should be used very early in the season, diluted ten times.

Two methods of culture were tried. One was the common way of planting in hills seven feet apart each way. In these hills was put a good shovel full of composted barnyard manure. The other method was to take a turning plow and throw up long ridges about four feet wide and eight feet apart. The seed was then drilled along on this ridge after it had been well harrowed. The ridge method proved to be decidedly better. The melons ripened earlier and were more abundant.

The following fertilizers were used singly and in combination: Composted barnyard manure mixed with wood ashes, nitrate of soda, potassium sulphate, and bone black. All were well raked into the ground before the seed was planted. All were beneficial, except nitrate of soda, which gave very negative results. The fertilizer which gave the best results was 300 pounds of bone black thoroughly mixed with 200 pounds of potassium sulphate and applied at this rate for an acre.

VARIETAL TEST.

The soil for this test is the same as that used for sweet potatoes, and is not well adapted to melons. The work has been carried on for two years. March 31, 1894, the seed was planted in hills made seven feet apart each way. This date is rather late for this latitude. For the test of 1895 the seed was planted March 23rd, which date proved better.

The following short notes are given on the varieties which have been under test for two years:

Arlington Long Yellow.—Medium productive; slightly ribbed and netted; ripe June 24th. Not recommended.

Bay View.—Large, prolific, oblong, ribbed and netted. Not recommended.

Banana.—Grew two feet long, corrugated, tapers toward stem end, has tough skin, and would ship well; ripened June 29th; table quality good, flesh light red. Average weight four pounds.

Banquet.—Round, much netted, would ship well; flesh thick, reddish yellow; table quality very fair; ripens June 27th. Average weight $1\frac{1}{2}$ pounds.

Bird Cantelope.—Large oblong, ribbed and netted, prolific. It seems promising.

Baltimore Nutmeg.—A fine strain of the nutmeg type, much netted and ribbed; flesh thick and green; flavor very good; ripened June 28th; average weight 5 pounds and 10 ounces.

Burpee's Melrose.—Nearly round, slightly ribbed and much netted; good size, and would ship fairly well; flesh golden yellow and of high flavor; ripened June 24th. Average weight 3 pounds and 10 ounces.

Cannon Ball.—Round to oval, slightly ribbed, highly netted; flesh greenish yellow, flavor very fair; very prolific; one of the best for shipping owing to the extremely small cavity; ripened June 26th. Average weight 3 pounds.

Columbus.—Nearly round, rather irregular in shape, much netted; would ship fairly well; flesh thick greenish yellow; flavor very fair; ripened June 27th. Average weight 3 pounds.

Christiana.—Round, much flattened, has same type as Jennie Lind; much netted; would ship well; flesh thick; flavor very good; ripened June 28th. Average weight $1\frac{1}{2}$ pounds.

Champion Market.—Belongs to nutmeg type; round, slightly ribbed, much

netted; flavor very good; ripened June 28th. Average weight 1 pound and 2 ounces.

Casaba.—Large and oblong; much ribbed and netted, would ship well; flesh greenish yellow; flavor very fair; ripened June 24th. Average weight 5 pounds.

Chicago Nutmeg.—Nutmeg type, cavity large; would not ship well; flesh green; flavor very fair; ripened June 28th. Average weight 4 pounds.

Delmonico.—Much netted, deeply ribbed, large, prolific; flesh reddish yellow, thick and of fair flavor; ripened June 24. Average weight 4 pounds and 13 ounces.

Emerald Gem.—Round, slightly netted, would ship well; flesh reddish yellow and of high flavor; ripened June 27. Average weight 2 pounds and 9 ounces.

Extra Early Green Nutmeg.—Nutmeg type, very large and prolific, would not ship well; flesh greenish yellow and of medium flavor; ripened June 28. Average weight 3 pounds and 7 ounces.

Extra Early Green Citron.—Very early, small; flesh light yellow, rather soft; quality very good; ripened June 23. Average weight 1½ pounds and 2 ounces.

Extra Early Hackensack.—Round, very large, deeply ribbed and much netted; would not ship well; ripened June 30. Average weight 8 pounds and 10 ounces.

Early Netted Gem.—Oblong to round; very small; flesh green and of excellent flavor; ripened June 24. Average weight 1 pound and 14 ounces.

Giant Chicago.—Seed badly mixed; the type seemed to be round and slightly ribbed and much netted; very prolific; flesh yellowish green and of fair flavor; ripe June 27. Average weight 1 pound and 13 ounces.

Hackensack.—Round and much ribbed; much netted, would not ship well; flesh yellowish white, quality only fair; ripened June 27. Average weight 4 pounds and 13 ounces.

Henderson's Banquet.—Round, small, slightly ribbed and much netted; prolific; good flavor; ripened June 27. Average weight 2 pounds and 7 ounces.

Jennie Lind.—Round and much flattened; slightly ribbed and netted; flesh green and very sweet, ripened June 24. Average weight 1 pound and 12½ ounces.

Livingston's Market Nutmeg.—Very large, deeply ribbed and much netted; prolific; flesh green and of high flavor; ripened June 27. Average weight 6 pounds and 9 ounces.

Large Green Nutmeg.—Round, slightly ribbed and much netted; very large and prolific; would not ship well; flesh green and of high flavor; good for home market; ripened June 30. Average weight 6 pounds and 2 ounces.

Maule's Superior.—Round, much flattened, flesh green and of high flavor; would ship well; ripe June 30. Average weight 1 pound and 10 ounces.

Miller's Cream Nutmeg.—Slightly ribbed and much netted; flesh solid; dull cream color; no good here; ripened July 2nd. Average weight 3 pounds and 10 ounces.

Montreal Market.—Seed was so mixed no notes of importance could be made.

New Tip Top Nutmeg.—Round, slightly ribbed and somewhat netted; would not ship well; flesh of reddish yellow and of high flavor; ripened June 30th. Average weight 4 pounds and 5 ounces.

Nutmeg.—Small, green fleshed; good flavor, as are most nutmegs; ripened June 25th. Average weight 2¾ pounds.

New Orleans Market.—Large, much netted and ribbed; round, would ship well; flesh thick and light yellowish green; very fair flavor; much grown in Louisiana for the New Orleans market, hence its name; ripened June 27th. Average weight 2 pounds and 9 ounces.

New Giant.—Round, much flattened, not netted; would not ship well; poor flavor; ripened June 24th. Average weight 8 pounds and 10 ounces.

Osage.—Much ribbed and little netted; flesh green; ripened June 24th. Average weight 2¾ pounds.

Pine Apple.—Oblong and slightly pointed at both ends; slightly ribbed and highly netted; flesh light greenish yellow and of high flavor; would ship well, but is small; ripened June 24th. Average weight 1 pound and 6 ounces.

Perfection.—Round, much ribbed and netted; would not ship well; flesh thin and yellow; quality only fair; ripened June 27th. Average weight 3 pounds and 2½ ounces.

Redland Giant.—Round, large, ribbed and much netted; flesh green and thin; poor flavor; ripened June 27th. Average weight 2 pounds and 13 ounces.

Skillman's Netted.—Round, slightly ribbed, highly netted; prolific; flesh red-

dish yellow and of very fair flavor; nutmeg type; ripened June 28th. Average weight 3 pounds and 14 ounces.

Superior.—Round, small, ribbed, and smooth, prolific; flesh yellow; rind thin; flavor good; ripened June 24th. Average weight 3 pounds and 6 ounces.

Southern Beauty.—Round, highly netted, medium size and slightly ribbed; would not ship well; flesh yellow and of excellent flavor; one of best for family use; ripened June 24th. Average weight 3 pounds and 1 ounce.

The Cannon Ball, owing to its extremely small cavity, is one of the best shipping melons. Its table quality is also very fair. It originated near Dallas, Texas, and was introduced a few years ago by the Texas Seed and Floral Company of that place.

The following are also recommended for shipping: Emerald Gem, New Orleans Market, Pine Apple, Maule's Superior, and Early Netted Gem.

The following are recommended for home and table use: Jennie Lind, Early Netted Gem, Pine Apple, Banquet, New Orleans Market, and Southern Beauty.

The earliest melons are perhaps Nette Gem, Jennie Lind, and Pine Apple. The cross we have obtained between the Early Netted Gem and the Emerald Gem gives great promise for an all-purpose melon.

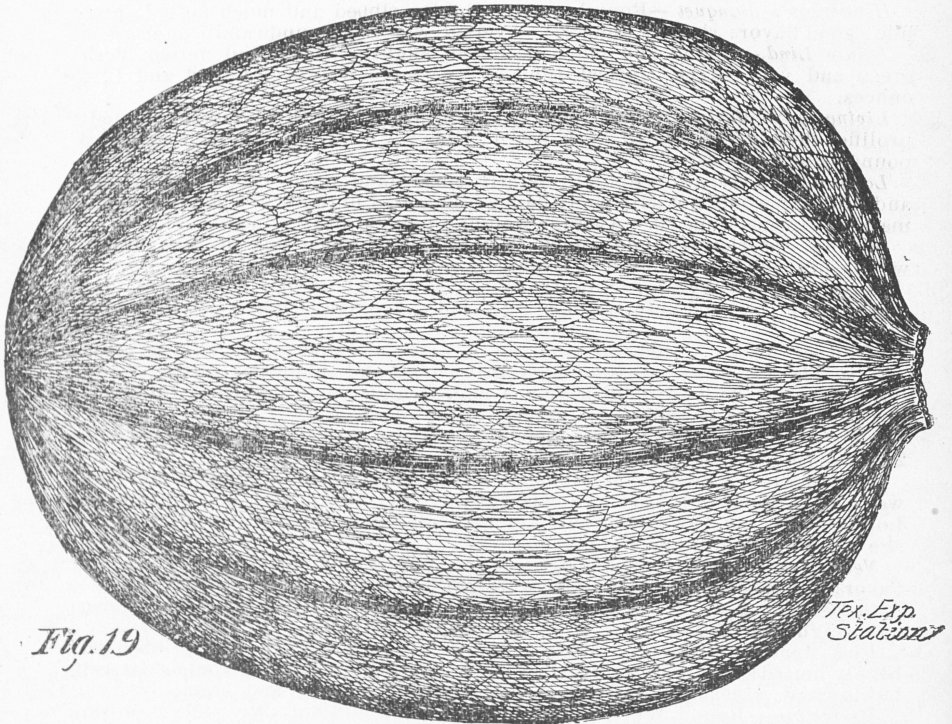


Fig. 19

Tex. Exp.
Station

(Natural size.)

FIG. No. 19.—*Early Netted Gem*.

CELERY.

R. H. PRICE, B. S.

During the past two years (1893-1894) we have carried on experiments with celery; the object being to find some variety and method by which this important vegetable could be grown in the State throughout the year successfully. It is a well known fact that much of our celery comes from Michigan, and any knowledge which would encourage the growth of this vegetable in the State would mean dollars kept at home. We have grown celery here both in the spring and in the fall, with fair success even on a rather poor, dry, upland soil. The seed was sown in trays which were placed in hot-bed January 25, and the plants were set in the field April 25, for the spring crop.

The following brief notes are given on varieties we have had under test:

Boston Market.—Grew 12 inches high, was not diseased, color dull green, hard to blanch.

Giant Paschal.—The largest variety, slightly diseased, blanches easily, best of the large varieties.

Golden Dwarf.—Grew rather large, blanches easily, affected slightly by rust, a good variety.

Golden Self-Blanching.—Grew 12 inches high, free from disease, easily blanched and is very beautiful.

Giant White Solid.—Grew 15 inches high, affected some by rust, hard to blanch, nothing to recommend it save its size.

Henderson's Perfected White Plume.—Medium size, affected some by rust, blanches fairly well.

Henderson's Dwarf White.—Very small, blanches fairly well, affected some by rust, color dull greenish white, can be planted very close.

Henderson's New Rose.—Grew 12 inches high, not diseased, has a beautiful purple color, blanches easily and is desirable.

Henderson's Half Dwarf.—About the same as Henderson's Dwarf White.

London Red.—About the same as Henderson's New Rose.

Sandringham Dwarf White.—Very dwarf, affected some by rust; not recommended.

There was not much difference in the time of edible maturity of the varieties, and celery from all was pulled July 9th. Two methods of blanching were tried. One method was to grow the celery on the ground about 6 inches apart each way to see if it would not spindle up and blanch itself. This method was a failure here. The intense heat and light kept the plants small and green. The weeds were difficult to keep out when grown so close. The other method was the old one of keeping the dirt up around the plants as they grew. This method proved fairly successful.

The fall crop, which was nearly all gathered last December 24th, was much better than the spring crop, though it should be stated that irrigation was used on this crop. The seed for this crop was sown first of August in trays and covered lightly with sphagnum moss until it germinated. The trays were kept slightly moist after being placed in the shade. I have always grown more thrifty plants by potting them in 2 inch rose pots than by letting them grow entirely in the bed. Several insects attacked the young plants, and it was found necessary to spray them with three ounces of London purple stirred into twenty-five gal-

lons of water. Considering our results here, and observations at other places, it seems safe to conclude that celery growing can be made a paying industry in the State. The vegetable requires a rather moist, rich soil, but with irrigation and manures, it can be grown successfully on a rather indifferent soil. The best varieties tested here are Giant Paschal, Henderson's Rose, and Golden Self-Blanching. Celery seed was purchased of Peter Henderson & Co., New York City, N. Y.

VARIETIES OF BEANS.

R. H. PRICE, B. S.

The variety test of beans has been carried on only one year. The soil upon which the test was made has the same characters as the soil previously described for sweet potatoes. After preparing the soil thoroughly, the beans were drilled in rows three feet apart, 30th of March, 1894. The ground was kept loose by stirring it with a small cultivator. It was never cultivated in the morning while the dew remained on the foliage. It is stated that cultivation then helps to bring on a disease (anthracnose) which discolors the pods. It might be well to state here that beans should not be planted for a large crop only on rather light, well drained soil, as they are almost sure to be diseased on low wet soil. The following table gives dates of bloom, edible maturity, class, and productiveness of the varieties.

The following were among the most desirable early varieties which were comparatively free from disease: Extra Early Refuge, Golden Eyed Wax, Cylinder Black Wax, and Henderson's Earliest Red Valentine.

Scarlet Runner has beautiful blooms and makes a desirable ornamental variety.

Table No. 9.

Name of variety.	Source of seed.	Date of first bloom.	Date of edible maturity	Class.	Productiveness, 0 to 10.
Burpee's Black Wax.....	W. A. B. & Co.	May 10..	May 17..	Dwarf.....	8
Burpee's New Stringless.....	W. A. B. & Co.	May 4..	May 15..	Dwarf.....	6
Burpee's Sunshine Wax Pole.....	W. A. B. & Co.	May 18..	May 22..	Runner.....	9
Black Wax.....	Hend.....	May 8..	May 16..	Dwarf.....	8
Cylinder Black Wax.....	Hend.....	May 10..	May 17..	Dwarf.....	10
Dwarf Horticultural.....	Hend.....	May 8..	May 11..	Dwarf.....	7
Early Mohawk.....	Hend.....	May 11..	May 18..	Dwarf.....	7
Early China.....	Hend.....	May 9..	May 19..	Dwarf.....	8
Early Warwick.....	Hend.....	May 9..	May 12..	Dwarf.....	6
Early Red Valentine.....	Hend.....	May 8..	May 18..	Dwarf.....	9
Early Golden.....	Hend.....	May 15..	May 22..	Runner.....	8
Extra Early Refuge.....	Hend.....	May 10..	May 17..	Dwarf.....	9
Emperor William.....	Hend.....	May 1..	May 15..	Dwarf.....	6
Flageolet Wax.....	Hend.....	May 3..	May 15..	Dwarf.....	8
Golden Champion.....	Hend.....	May 15..	May 22..	Runner.....	8
Golden Wax.....	Hend.....	May 4..	May 15..	Dwarf.....	9
Golden Eyed Wax.....	Hend.....	April 30	May 15..	Dwarf.....	8
Horticultural or Speckled Cranberry..	Hend.....	May 18..	May 30..	Runner.....	7
Henderson's Earliest Red Valentine...	Hend.....	May 8..	May 12..	Dwarf.....	8
Large White Kidney.....	Hend.....	May 15..	May 22..	Dwarf.....	8
Large Yellow Six Weeks.....	Hend.....	May 3..	May 10..	Dwarf.....	9
Old Homestead.....	Hend.....	May 15..	May 25..	Runner.....	8
Pole Bean.....	Hend.....	May 28..	June 10..	Runner.....	9
Refuge, or 1000 to 1.....	Hend.....	May 22..	June 5..	Runner.....	8
R. I. Dwarf Case Knife.....	Hend.....	May 1..	May 8..	Dwarf.....	9
Round Early Six Weeks.....	Hend.....	May 4..	May 12..	Dwarf.....	8
Thorburn's Extra Early.....	Thorburn	May 11..	May 22..	Runner.....	8
White Valentine.....	Hend.....	May 12..	May 18..	Dwarf.....	8
White Marrow.....	Hend.....	May 21..	June 1..	Semi-Runner	6
White Seeded Wax.....	Hend.....	May 3..	May 15..	Semi-Dwarf..	8
White Dutch Runner.....	Hend.....	May 28..	June 8..	Runner.....	8
Wardwell's Dwarf Kidney Wax.....	Hend.....	May 3..	May 15..	Dwarf.....	7
Yosemite Mammoth Wax.....	Hend.....	May 12..	May 18..	Dwarf.....	7

LIMA OR BUTTER BEANS.

The bush Lima beans, like the Vineless sweet potato, have added a new race of vegetables to our garden products. They have all appeared in the United States within the last eleven years. Nearly all of them have been found growing among other vine varieties. Those which have originated in the South seem much better adapted to this soil and climate than those which have originated in the North. Just how these dwarf plants originated is not exactly known. They offer a subject for speculative discussion. The small, slender growing varieties, with numerous small papery pods, which are curved on the back, split open and twist when ripe, being inclined to throw out their small, soft, variously colored beans, are known as Sieva or Sewee beans. Those with taller growth, later, thicker leaves and fewer, fleshier pods, larger beans, are known as true Lima beans. The Sievas have been much more productive with us than the true Limas.

Burpee's Bush Lima.—A true dwarf Lima or butter bean. Pods large, and contain two to three large beans; late, but is fairly productive. Originated in Pennsylvania.

Dreer's or Kumerle Dwarf Lima.—The pods and beans are much smaller than those of Burpee's Dwarf Lima. They are borne near the ground and are apt to spoil during damp weather. Is late and not productive. Originated in New Jersey. Is the same that has been sold in this State as Dallas Bush Lima.

Henderson's Bush Lima.—A Sieva variety. Earliest of the Limas tested here, and the most prolific. Two excellent crops have been grown here in one year. The seed for the second crop was saved from the first crop and planted 20th of August. The beans are rather small and flat, but of good flavor. Found growing wild in Virginia.

Jackson.—This variety is the same Lima sold as Jackson's Wonder. Differs from Henderson's in having brown, speckled beans. Early and prolific. Sieva type. Originated in Georgia.

Willow Leaf Lima.—This is a very peculiar running variety which has proven itself to be prolific but late. Its leaves remind one very much of those of the common willow, hence its name; Sieva type. Beans small, round, white.

Extra Early Black Pole.—A very prolific, early, running variety. Sieva type. Beans much flattened, black purplish on one end.

The following Lima varieties are recommended: Henderson's Bush Lima as Dwarf variety, of the two different types of Dwarfs, and Extra Early Black Pole as a running variety. Large White Lima has done tolerably well as a pole variety, and is recommended for planting in small quantities for home use only this far South.

Our work with cabbage, cauliflower, and tomatoes was planned by myself. The details of the work were entrusted to Assistant Professor of Horticulture, Mr. H. Ness, who has submitted a report on the experiments.

VARIETIES OF CABBAGE, CAULIFLOWER AND TOMATOES.

H. NESS, B. S.

The soil of our plots consists of a stiff loam, made up of a mixture of black sand and clay, with but little organic matter in it. This is underlaid by a grayish clay, so stiff that it does not admit of easy subsoiling, and is so void of pores that it neither takes up nor holds a sufficient quantity of water. Though many plants may prefer clayey and somewhat stiff soil, such soil must be porous, not only to make it a reservoir of moisture, but also to allow a good circulation of air, so necessary for the growth of the roots, and the promotion of those chemical changes incidental to the creation of plant food.

Our soil has for several years received annual dressings of stable manure, ashes and cotton seed meal, so that the small yields shown by weight of the heads is not due to lack of food, but to the compact condition of the soil, which prevents the plants from obtaining the food.

VARIETIES OF CABBAGE.

The seed was sown on the 16th of February, 1895, in boxes about 4 inches deep and of suitable length and breadth, so that they could be handled with ease. The dirt used was a mixture of sand, garden soil, and enough thoroughly rotten manure to make it loose and rich. After sown and sprinkled the boxes were dusted with a mixture of slacked lime and sulphur, to prevent the growing plants from "damping off." The boxes were placed in a hot-bed and covered with glass. The plants came up from three to five days after sowing. The glass sashes were from that time kept open, whenever the temperature was high enough not to injure the plants. The temperature most favorable to production of strong and vigorous plants is about from 55 to 60 degrees Fahrenheit. Plenty of fresh air and sun is necessary to prevent the plants from growing rank and damping off, but in case of too hot sun they must be shaded.

As soon as our plants were large enough, that is, when the second pair of leaves began to show themselves, they were transplanted into 3-inch flower pots, and those for which we lacked pots were transplanted into fresh boxes in order to give them the necessary room. Only pot grown plants, however, were used in our experiment, as these were not only superior in size, but were almost perfect as to regularity, size, and quality. Such plants can be transplanted into the field without risk of loss, either in number or in vigor, even when the soil is not in the best condition.

On the 5th of April the plants were, with the ball of dirt undisturbed, planted in the field, which had previously been given a coating of stable manure, and also by previous culture brought into the proper tilth. The plants grew satisfactorily until the latter part of May, when they commenced to suffer from drouth. On the first of June one-half of each plot was irrigated.

The following table, in which I preserve the order in which they were

planted, shows the comparative earliness and size of those irrigated and those not irrigated:

Table No. 10.

No.	Varieties.	Seedsmen.	Time of first cutting.	Average weight per head, unirrigat'd	Average weight per head, irrigated.
1	Hen. Selected Ey. Jersey Wakefield.....	Hend.....	May 31 ...	2 1-2 lbs.....	3 1-2 lbs.
2	True Ey. Jersey Wakefield.....	Francis Brill *..	June 11... 3	lbs.....	3 17-20 lbs.
3	Large Ey. Jersey Wakefield	Francis Brill	May 31 ... 4	lbs.....	5 1-4 lbs.
4	Large Ey. Jersey Wakefield	G. T. & S.....	June 11... 1	17-20 lbs..	2 7-20 lbs.
5	Tait's True Ey. Jersey Wakefield	G. T. & S.....	May 31 ... 3	1-2 lbs.....	4 1-20 lbs.
6	Tait's Extra Ey. Pilot	G. T. & S.....	June 11... 4	1-4 lbs.....	4 2-5 lbs.
7	Extra Ey. Etampes.....	Francis Brill	May 31 ... 3	3-5 lbs.....	4 3-20 lbs.
8	Tait's Extra Early.....	G. T. & S.....		No heads...	
9	Newark Ey. Flat Dutch	Francis Brill	June 18... 3	3-5 lbs.....	5 11-20 lbs.
10	Newark Flat Dutch.....	G. T. & S.....	June 11... 2	3-4 lbs.....	4 7-20 lbs.
11	Premium Flat Dutch	G. T. & S.....	June 18... 2	3-5 lbs.....	4 4-5 lbs.
12	Premium Late Flat Dutch	Francis Brill	June 18... 2	No heads...	4 lbs.
13	Ball's Excelsior Flat Dutch	Francis Brill	June 18... 2	No heads...	3 13-20 lbs.
14	Louisville Extra Drumhead	Francis Brill	June 18... 2	1-5 lbs.....	3 2-5 lbs.
15	Improved Large Late Drumhead.....	Francis Brill	June 20... 5	No heads...	5 3-20 lbs.
16	Perfection Drumhead Savoy	Francis Brill	June 25... 2	No heads...	2 7-10 lbs.
17	Burpee's Shurehead	Francis Brill	June 25... 2	No heads...	3 9-10 lbs.
18	Louisville Drumhead.....	G. T. & S.....	June 18... 1	1-2 lbs.....	4 lbs.
19	Grand Duke	G. T. & S.....	June 25... 2	No heads...	3 7-10 lbs.
20	World Beater	G. T. & S.....	June 26... 4	No heads...	4 3-5 lbs.
21	Fottler's Improved Brunswick.....	Francis Brill	June 18... 2	lbs.....	4 3-5 lbs.
22	Brill's Nonsuch	Francis Brill	June 18... 2	7-20 lbs..	6 lbs.
23	Warren's Stone Mason.....	Francis Brill	June 26... 2	No heads...	3 13-20 lbs.
24	Mammoth Red Rock	Francis Brill	June 26... 4	No heads...	4 1-2 lbs.
25	Early Winningstadt.....	Francis Brill	June 11... 1	7-20 lbs..	3 2-5 lbs.
26	Early Winningstadt.....	G. T. & S.....	June 26... 1	2-5 lbs.....	3 13-20 lbs.
27	Burpee's All Head Early	Burpee.....	June 11... 1	9-10 lbs..	4 1-4 lbs.
28	Burpee's All Head Early	Francis Brill	June 11... 2	3-10 lbs..	5 3-4 lbs.
29	Early Summer	Hend.....	June 11... 2	3-10 lbs..	5 7-10 lbs.
30	Hen. Early Summer	Francis Brill	June 11... 2	1-5 lbs.....	4 lbs.
31	Hen. Succession.....	Francis Brill	June 11... 3	lbs.....	5 3-5 lbs.
32	Succession.....	G. T. & S.....	June 11... 3	lbs.....	4 9-20 lbs.
33	All Seasons.....	G. T. & S.....	June 11... 2	1-2 lbs.....	3 9-10 lbs.
34	All Seasons.....	Francis Brill	June 11... 2	7-20 lbs..	3 3-5 lbs.

*Francis Brill, Hempstead, Long Island, N. Y. The addresses of the other seedmen will be found on pages 629, 630.

The first cutting was made before the heads were fully grown, yet large enough for market; the weights were taken from eight to twelve days later, when the heads were fully matured. Very few of those whose first cutting was made after the 11th of June headed up on unirrigated ground, and those that did grew only small and irregular heads not fit for market. This was of course owing to the increasing heat, which after the 25th of June became strong enough to cause them to give off that peculiar odor signifying fermentation. As seen from the table, the varieties most worthy of recommendation are the Jersey Wakefields, Tait's Pilot, Flat Dutch, and Henderson's Succession.

Henderson's Selected Early Jersey Wakefield and *True Early Jersey Wakefield* are very similar, both producing oval heads with a rather pointed apex, and having uniform size; the only and very slight difference in appearance is that the lower leaves seemed larger in the latter variety.

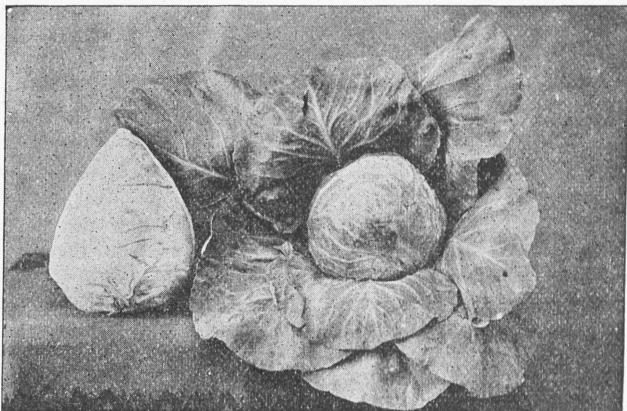


FIG. NO. 20. *Early Jersey Wakefield.*

Tait's True Jersey Wakefield is another variety of this class to be recommended. The name indicates a synonym with No. 2, though it is shown in the table that it is not only earlier but also larger; and it was of a more rounded form than the above mentioned.

Large Early Jersey Wakefield differed from Nos. 1 and 2 in producing more rounded and, as its name might suggest, larger heads. This variety was, without exception, the best in our plots, in regard to size, earliness and uniformity.

Tait's Extra Early Pilot, with oval heads and large lower leaves, though a good variety, appeared less uniform, both in shape and in size, than the varieties above.

Extra Early Etampes is objectionable on account of irregularity in size, and too many fail to produce heads. The same can be said of *Tait's Extra Early*, which made no heads at all. Both suffered much from heat and insects, which, however, are only general indications of unadaptability to our conditions of soil and climate.

Newark Early Flat Dutch, *Newark Flat Dutch* and *Premium Flat Dutch*, Nos. 9, 10 and 11 in the table, are all similar, having round flat-shaped heads. They are so much later than the *Jersey Wakefields* that their full development was, on account of the increasing heat, not reached on unirrigated ground. They are all to be recommended, however, to market gardeners having a deeper and moister soil, as good varieties, with solid heads of uniform size.

Henderson's Early Summer, Nos. 29 and 30 in the table, produced rounder and somewhat flatter topped heads, and is much to be recommended for solidity and uniformity in size.

Henderson's Succession, Nos. 31 and 32, is similar in appearance to *Early Summer*, but larger, and hence of higher merits.

All Season, Nos. 33 and 34, has round heads and coarse veined leaves, and proved somewhat irregular, both with respect to time of heading up and to size.

Several of the *Savoy*, or crimped head cabbages, so celebrated for their tenderness and mild flavor, have from time to time been given trials here, but so far they have made no success, neither as a spring nor as a fall crop; still they have done so much better in the fall, that with a proper start early in September, and on better land than we have, they will, in a moderate season, certainly reach maturity before freezing. For spring they are not to be recommended, at least not for our slowly producing thin upland soil, as they are certain to be killed by heat just before the time of heading up.

VARIETIES OF CAULIFLOWER.

Varieties of this vegetable have been tested here, both as a spring and as a fall crop. As a spring crop they were a complete failure in 1894, as they failed to head up. In the year 1893 the following early varieties made heads of moderate size, but rather leafy, tough, and discolored by the sun; hence unmarketable: Early Snowball, Earliest Erfurt Dwarf, Early Perfection and Worldbeater. These same varieties, of which Erfurt Earliest Dwarf has proven the best for this place, have given more satisfaction as a fall crop.

It is a difficult task to procure a good stand of cauliflower for fall in this locality, as they are likely to suffer, both from heat and lack of moisture, more than the cabbage. Our method of raising the young plants is the same as pursued in raising cabbage for fall crop; namely, to sow in shallow boxes during the latter part of July or the beginning of August, and place the boxes in a cold-frame, over which a shed is erected. During very hot weather an almost constant sprinkling of the soil, planks and walks surrounding the boxes is kept up, to generate moisture and lessen the heat. When the plants are large enough, they are transplanted into flower pots, as prescribed for cabbage. It is best to do the transplanting on a cloudy or moist day; if not, drenching the boxes with water serves to bring the dirt into the consistency of a mud, and thorough sprinkling immediately after transplanting, will prevent any serious loss. During rainy weather, the plants must be very carefully guarded against dripping from the roof, as this is apt to cause them to damp off at once. Transplanting into the field takes place in September, as soon as the size of the plants (the proper size is from four to five inches in height) and the climatic conditions will allow.

VARIETIES OF TOMATOES.

The experiment with tomatoes has, as in the case of cabbage and cauliflower, been carried on for two years (1893-94), and for the same purposes. The soil of the plots and the treatment they were subjected to, previous to planting of tomatoes, are also the same as described under the head of cabbage. It will be seen from that description that our soil is even less suitable to tomatoes than to cabbage. The tomato needs a porous, sandy loam of no very high degree of fertility. The red sandy soil underlaid by a dark red porous clay, found throughout the piney region of East Texas, as well as in spots here and there through other parts of the State, produces tomatoes not surpassed in size, beauty, and flavor, by any country. The tomato, with every year, is becoming more important in the State as a crop for shipping.

An all-important consideration to the gardener who raises tomatoes for shipping, is what kind of varieties to plant. In regard to habit of growth, there are two kinds of varieties; those with a long, flexible, and diffuse stem, requiring a support to keep them up from the soil, and those with a dwarf, bushy, and erect (or nearly erect) stem, requiring no support. The latter class is much easier and cheaper to cultivate, inasmuch as they can be plowed and the fruit gathered at any time with-

out bruising or mangling the vines. They are also less liable to diseases brought on by exposure to too hot sun, or by contact with damp and mouldy soil. These dwarf varieties are at present very few in number compared with the others, but because of the many advantages which they offer, their further development and increase, either by selection or by crossing, ought to be one of the objects for the future.

Our tomato seed was last year (1894) sown in boxes on March 1, and treated as described for cabbage and cauliflower. In that year, we planted about two weeks earlier, in consequence of which the plants grew too large before they could be risked out in the open field. Pot-grown tomato plants were on our soil more even in size and vigor, and came earlier into bearing than those not pot-grown. On sandy loam, I presume the difference between potted and unpotted tomato plants is very small, if any, because on such soil no plants suffer so much from transplanting as they do on compact sandy clay. Only potted plants were therefore used in our experiment. The transplanting into experimental plots was done on April 15. The plants grew well until the latter part of June, when they were seriously checked by the hot and dry wind, from the effects of which much of the fruit was sun scalded, and the rest remained below the average size during the entire test. Only three plants in each row were used in obtaining the weight and number of the fruit.

The following table gives a comparison of the results:

Table No. II.

Number.	Name of Variety.	Seedmen.	Number of Fruits Sound.	Number of Fruits Rotten.	Weight in Pounds.	Habit of Growth.	Color.
1	Acme	Hend	75	19	5 3-20	Diffuse	Blood red.
2	Acme	Liv	45	7	19-20	Diffuse	Cherry red.
3	Atlantic Prize.....	Liv	94	1	12 1-10	Diffuse	Yellowish red.
4	Beauty	G. T. & S.	32	17	3 3-5	Diffuse	Yellowish red.
5	Canada Victor.....	Liv	125	22	12 9-10	Diffuse	Yellowish red.
6	Cardinal.....	Liv	59	23	6 3-10	Diffuse	Yellowish red.
8	Dwarf Champion.....	Liv	50	17	6 3-5	Dwarf	Blood red.
9	Early Advance.....	Liv	142	9	10 9-10	Diffuse	Reddish yellow.
10	Early Conqueror.....	Liv	No fruit.			Diffuse	
11	Early Ruby	Liv	91	10	10 17-20	Diffuse	Yellowish red.
12	Early Ruby	Hend	67	2	11	Diffuse	Yellowish red.
13	Early Red.....	Liv	60	34	6 3-4	Diffuse	Yellowish red.
14	Essex Hybrid.....	Liv	189	30	8 3-10	Diffuse	Cherry red.
15	Fordhook First.....	Burpee	71	19	3 1-4	Diffuse	Red.
16	Golden Sunrise.....	Hend	68	49	3 2-5	Diffuse	Pale yellow.
17	Hain's 64.....	T. S. F. Co.	51	6	7 17-20	Diffuse	Cherry red.
18	Hathaway's Excelsior.....	Liv	62	7	5 11-20	Diffuse	Reddish yellow.
19	Henderson's Ponderosa.....	Hend	32	4	15 3-10	Diffuse	Cherry red.
20	Ignotum.....	Hend	56	16	9 1-20	Diffuse	Cherry red.
21	Ignotum.....	Liv	112	30	6 1-12	Diffuse	Cherry red.
22	Livingston's Beauty.....	Liv	40	37	4 4-5	Diffuse	Cherry red.
23	Livingston's Beauty.....	Hend	48	21	6 4-5	Diffuse	Blood red.
24	Livingston's Buckeye State.....	Liv	17	2		Diffuse	Pale yellow.
25	Livingston's Dwarf Aristocrat.....	Liv	40	1	5 1-5	Dwarf	Yellow redish.
26	Livingston's Favorite.....	Liv	65	41	6 1-2	Diffuse	Reddish yellow.
27	Livingston's Favorite.....	Hend	70	23	9 19-20	Diffuse	Reddish yellow.
28	Livingston's Gold Ball.....	Liv	170	4	6 7-20	Diffuse	Pale yellow.
29	Livingston's Golden Queen.....	Liv	51	32	4 3-4	Diffuse	Yellowish red.
30	Livingston's Perfection.....	Liv	61	43	5 17-20	Diffuse	Yellowish red.
31	Livingston's Royal Red.....	Liv	36	19	4 1-10	Diffuse	Yellowish red.
32	Livingston's Stone Tomato.....	Liv	40	18	6 1-10	Diffuse	Yellowish red.

Table No. 11—continued.

Number.	Name of Variety.	Seedmen.	Number of Fruits Sound.	Number of Fruits Rotten.	Weight in Pounds.	Habit of Growth.	Color.
33	Lemon Blush	Burpee.....	61	11	8 2-5	Diffuse	Pale yellow.
34	Lorillard	Liv.	41	13	5 2-15	Diffuse	Yellowish red.
35	Matchless	T. S. F. Co.	44	34	4 1-2	Diffuse	Reddish yellow.
36	May Flower.....	Liv.	56	29	6 19-20	Diffuse	Reddish yellow.
37	Mikado.....	Liv.	23	4	3 3-5	Diffuse	Blood red.
38	Mikado.....	Hend.	51	13	6 1-2	Diffuse	Cherry red.
39	Mikado.....	G. T. & S.	47	12	8 9-20	Diffuse	Cherry red.
40	Nestor	Thor.	31	.....	3 1-5	Dwarf	Yellow red.
41	New Dwarf Champion.....	Hend.	48	14	5 7-10	Diffuse	Red.
42	Northern Light.....	Thor.	30	1	5	Diffuse	Yellow.
43	Optimus.....	Hend.	63	34	6 13-20	Diffuse	Yellowish red.
44	Perfection.....	G. T. & S.	52	34	4 1-20	Diffuse	Yellowish red.
45	Perfection	Hend.	48	39	4 3-4	Diffuse	Reddish yellow.
46	Paragon	Hend.	37	15	3 1-20	Diffuse	Yellowish red.
47	Potato Leaf.....	Liv.	51	12	7 3-20	Diffuse	Cherry red.
48	Red Queen.....	Liv.	40	19	6 19-20	Diffuse	Cherry red.
49	Royal Red.....	T. S. F. Co.	34	23	6 19-20	Diffuse	Cherry red.
50	Table Queen.....	Hend.	21	18	1 7-20	Diffuse	Pale yellow.
51	Terra Cotta	Burpee.....	48	7	4 3-10	Diffuse	Reddish yellow.
52	The Shah	Hend.	38	7	6 7-10	Diffuse	Reddish yellow.
53	Thorburn's Lem'n Blush.....	Thor.....	48	10	4 11-20	Diffuse	Pale yellow.
54	Thorburn's Terra Cotta.....	Thor.....	101	28	10 3-4	Dwarf	Pinkish yellow.
55	Trophy	Liv.	26	16	4 2-5	Diffuse	Yellowish red.
56	Trucker's Favorite.....	Burpee.....	58	21	6 17-20	Diffuse	Cherry red.
57	Valentine.....	Liv.	27	23	2 1-2	Diffuse	Yellowish red.
58	Yellow Plum	Liv. ....	.....	.....	8 17-20	Diffuse	Yellow.
59	Yellow Husk.....	Liv. ....	.....	.....	.....	Ground cherry	Of little value.

There was no great difference in date of ripening of the earliest variety and nearly all other varieties, since most of them ripened their first fruit between June 28 and July 1. The following varieties have been marked desirable in my notes of 1894: Atlantic Prize, Ignotum, Livingston's Favorite, Livingston's Stone, and Ponderosa.

These were the best among those of diffuse growth, in regard to solidity, productiveness, and evenness in size and shape. They are all well known varieties, and need no description, with the exception of Livingston's Stone, introduced by Livingston's Sons in 1891, and Ponderosa, introduced by Henderson at the same time.

Livingston's Stone is a very prolific bearer, producing large yellowish-red fruit with small cavities and thick, firm flesh, and though the vine is rather diffuse and apt to lie down, it withstood the scalding sun of last summer well, compared with most other varieties of its class.

Ponderosa was this year the largest tomato in our experiment; it is a roundish, slightly ribbed fruit of a cherry red color; quality of fruit and nature of vine same as in the above. This variety, on a moist sandy loam, would certainly grow too large for shipping purposes. Last year it developed no particular characteristics to recommend it.

The following varieties have been marked as poor in my notes of last year: Beauty, Cardinal, Early Red, Essex, Fordhook's First, Golden Sunrise, Livingston's Buckeye State, Livingston's Royal Red, Livingston's Golden, Matchless, Mayflower, Paragon, Perfection, Table Queen, The Shah, Terra Cotta, and Volunteer.

Since the true characters of no variety of plants develop themselves except in a soil and a climate best suited to them, all these varieties may be called poor only as far as our soil is concerned; many of them, if

tried on other soils and in other localities, might prove well adapted. Terra Cotta, however, is an exception on account of the nature of its fruit, which is rather a semi-capsule with a leathery covering, reminding one of a pod of sweet pepper rather than of an ordinary tomato.

The following varieties are dwarfs: Dwarf Champion, Livingston's Aristocrat, Meteor, New Dwarf Champion, and Northern Light.

The Dwarf Champion, seed obtained from Livingston's Sons, did not this year quite come up to our expectation in the experimental plot, but with plants from home grown seed it was, as in the previous years, decidedly the best tomato on our ground. I here find it proper to copy the following description of this variety from an article published in the Texas Farm and Ranch, on our tomato experiments of last year: "The Dwarf Champion is comparatively a new variety of tomato, and differs from the other varieties in having a stout nearly erect stem, which in soil of ordinary fertility reaches a height of thirty to thirty-six inches. Having ample foliage, it is thus far less liable to sun scald than the more prostrate growing varieties; and it is, no doubt, owing to this erect habit of growth that it remains healthy until killed by frost, while all other varieties died in August." * * *

Livingston's Dwarf Aristocrat is another new variety, resembling the Dwarf Champion so much in leaves and stem that it can readily be mistaken for it; but the fruit, though like that of the Dwarf Champion in shape and size, differs from it in color, being bronze red. The short experience that I have had with the variety forbids me to recommend it as highly as I have the Dwarf Champion; yet my expectation is that it will prove itself to be of equal value.

Northern Light, with a bushy stem and bluntly ribbed, yellowish fruit, of medium size, is perhaps not so prolific as the two varieties just described.

Meteor seemed identical with Livingston's Dwarf Aristocrat.

The Upright Station Tree, from Thurburn & Co., was given a trial here last year, but unfortunately not included in our list of this year, is the most compact and bushy of all the Dwarfs that we have tested. The stem is about as tall as that of an average Irish potato, and much stouter and firmer, bearing a thick dark green foliage. The fruit, which is round, very fine and smooth, and of cherry red color, appeared a little too small on our grounds. This variety may prove a good one on soil well suited to tomatoes, where the fruit will be increased both in size and in number.

The Yellow Plum may be mentioned among the small fruit varieties as the best on our ground, in regard to productiveness and hardiness.

EFFECT OF PRUNING.—Pruning was practiced last summer during the latter part of August on several rows in a plot of Dwarf Champion, and had the beneficial results of increasing the productiveness and invigorating the plants after they had been weakened by drouth and lack of cultivation. Dwarf Champion, as well as all the other dwarfs, becomes top-heavy by age. The lower leaves fall off. The activity of growth is greatest in the tops, where also the fruit is being borne, and in consequence of the weight bend over or fall prostrate on the ground, thus obstructing passage between the rows, and preventing the necessary cultivation. The plants very soon become enfeebled and try to recuperate by starting numerous shoots from the base, which, however, seldom become strong enough to bear fruit.

The method of pruning pursued by us consisted in cutting off all the branches lying flat on the ground, and cutting the tops and drooping branches back to a lower vigorous shoot; thus relieving the plant of one-third or one-half of its growth, together with all of its fruit. The rows were then cleaned of weeds by plowing and hoeing, which of course cut many roots also. This soon induced a new growth of leaves and branches on the naked part of the stem. The new fruit was increased in size, and the plant remained vigorous until the frost.

REPRODUCTION FROM CUTTINGS.—Tomatoes grow, as is well known, with ease from cuttings. We have several times tried them for fall crop, and invariably had success, wherever the season has been favorable. A cutting ought to be about six inches long, taken from a vigorous and stocky shoot. The lower leaves should be removed and the cutting planted with one-half its length into the soil.

The best soil to start summer cuttings in is a sandy loam, and the best place is a cold-frame under shelter. When they show sign of growth, the shelter may be removed during not too hot and dry weather. They can be transplanted into open field when they have made a growth of about three or four inches and the roots have well started. By making the cutting during first of August, we have succeeded in having the plants come into bearing about the first of November, which can be done in a much shorter time on better soil, especially with irrigation. Another way of prolonging the tomato season, which we tried during 1894, was to cut the vigorous vines loaded with green fruit and bring them into a house just before a frost is expected to occur, and hang them up, where nearly all the fruit ripened well in from ten to fifteen days.

INSECTICIDES.

R. H. PRICE, B. S.

We mean by an insecticide anything used to kill insects. Recommendations for injurious insects and plant diseases are given in Bulletins No. 23 and No. 32, and the results of our experiments in preventing injury by weevils are given in Bulletin No. 31. Still, this Bulletin would not be complete for those whom it is intended to benefit if some general information on how to prevent injury by insects were not given. During the past seven years we have tested many things to prevent injury done by insects and by fungi, and feel confident in recommending the insecticides herein mentioned. It should be borne in mind, however, that the results from the use of an insecticide depend very much upon the manner of application. Insecticides must be applied in time, and in a thorough manner. "We can keep an enemy away cheaper than we can drive him away." Therefore all plants which are not of benefit and harbor insects should be destroyed. Frequently insects prey upon crops and are not noticed until they do great damage. It is in this case, as in most others, very important to be ready, observe, and begin early.

As regards their use, there are two general classes of insecticides; those used against biting insects which obtain their food from the outside of plants; second, those used against sucking insects which obtain their food from the inside of plants. For biting insects some form of the arsenical compounds, such as London purple or Paris green, is commonly used, and the insects are killed by eating the poison. For the sucking insects, which obtain their food from the inside of plants, some application is used which will close the breathing pores or affect the nervous system, such as kerosene emulsion or Persian insect powder. It is useless to use the arsenical compounds for sucking insects, while they are very effective for biting insects.

Insecticides are generally used in three forms; liquid spray, powder, and fumes or vapor. With the exception of carbon bisulphide we have usually obtained the best results in the form of a liquid spray, because in this form the preparations are distributed more thoroughly and stick on the plants better, but it is not always the most convenient method.

London Purple.—This is an arsenite of lime, obtained as a by-product in the manufacture of analine dyes. It contains from 30 to 50 per cent of arsenic. It is a lighter, finer powder than Paris green, and therefore is held in suspension in water better than Paris green. It frequently contains some soluble arsenic, which sometimes burns the foliage. This injury can be prevented by putting some lime in the water.

Paris Green.—This is an arsenite of copper. It contains about 58 per cent of arsenic. The wet preparation of this material must be stirred frequently to keep poison from settling to the bottom. For making a dry mixture of either one of the arsenical compounds mentioned, either plaster, flour, air-slaked lime, road dust or sifted wood ashes may be used as a diluent. A mixture of 1 part of the poison to 50 parts of the diluent often gives good results. Some plants will stand a mixture as strong as 1 of the poison to 20 of the diluent. In all cases the mixing

must be done thoroughly, and it is better to apply the mixture during a still morning while the dew is on the plants. For the wet preparations, the following mixture gives good results: 1 pound of the poison to 200 gallons of water. If some lime be added to the water a stronger mixture can be used on the plants safely. The preparation we have found best to fight insects and plant diseases with at the same time is 3 ounces of London purple stirred into 25 gallons of Bordeaux mixture. In this form the poison is held on the foliage a long time. The formula for all is 2 pounds of copper sulphate dissolved in 25 gallons of water and then add $2\frac{1}{2}$ pounds of unslaked lime, afterwards add 3 ounces of London purple. The London purple mixes more readily if a paste be made of it before putting it in the water. Of course these poisons must be kept at a safe distance from the family and all stock.

Bait.—Use 1 ounce of poison, 8 ounces of chopped grass or clover leaves; mix with syrup and roll into balls; spread the balls among the plants for wire worm, beetles, crickets, cut worms, etc.

For sucking insects kerosene emulsion is commonly used, and we have found the "Hubbard-Riley" formula to work very well, if the water be soft. Hard soap $\frac{1}{2}$ pound (preferably white oil soap), boiling water 1 gallon, kerosene oil 2 gallons. Churn or pump the mixture violently for 10 or 15 minutes, till it becomes like buttermilk. If there be any free oil it will kill the plants. Dilute 10 or 12 times before using. The following formula is also sometimes recommended: Sour milk 1 gallon, kerosene oil 2 gallons; warm slightly and mix thoroughly. Dilute as for the other emulsion.

Carbon Bisulphide.—This is a very foul smelling liquid which volatilizes at a very low temperature. It has a local Texas name, "high life." This local name seems to have come about by using some of the material on the hair of a stubborn pony or a mule to make it move. It is highly inflammable and should be kept at a safe distance from all fire. We have been very successful in using it for the red ant in the following manner: Pour two or three spoonfuls into the colony and cover with some dirt and press it firmly with the foot. After waiting one or two minutes stick a lighted match to the place and the fumes will burn with a very hot, invisible flame. During the hottest part of the day or early in the morning when all the ants are in, is the best time to apply it. A student in the senior class treated eighty ant beds here last spring under my direction in this way, and killed sixty of them by the first treatment. In about four days some of the ants will appear on the surface if they are not all killed. The application should then be repeated. This material can be bought much cheaper if it be ordered from some large dealer in 50 or 100 pound cans.

Pyrethrum or Persian Insect Powder.—This is a fine, light brown powder made from the heads of pyrethrum plants. It is not injurious to man, and can be used with impunity in the house for such insects as flies and mosquitoes. For the dry mixture use the pure powder. For the wet mixture use one ounce of powder to one gallon of water. Some care should be exercised to procure fresh powder, as it loses its strength when old or exposed to the atmosphere.

MACHINERY.

For the distribution of the powders we have not found a small machine which gave entire satisfaction. The larger of the Woodason machines, sold for \$2 by Thomas Woodason, Philadelphia, Pa., does fair work. For the wet preparation we have used satisfactorily a Jappy Spray Pump, with Vermorel nozzle and agate mortar, made by Robert Leitch & Sons, Washington, D. C., and sold for \$14, complete. There is a small hand force pump sold by nearly all dealers in spraying machinery, which is a very good cheap machine in helping to make the kerosene emulsion and spraying in a small way. The Climax Tripod is a good machine to attach to barrels and be hauled over the ground when spraying; it costs \$15. It should be requested of the manufacturer to use the agate mortar in the spraying machine, because kerosene emulsion will swell the rubber mortars and valves so that they will soon become useless. Before buying a machine it is well to write to several manufacturers for catalogues, so that a machine may be selected to suit the purpose desired. The addresses of some of the manufacturers are as follows: Albinson & Trusheim, 2026 Fourteenth Street, Washington, D. C.; Nixon Nozzle and Machine Co., Dayton, O.; Field Force Pump Co., Lockhart, N. Y.; P. C. Lewis, Catskill, N. Y.; Lansing Iron Works, Lansing, Mich.; Superior Machine Co., Springfield, O.; Wm. Stahl, Quincy, Ill.; Thomas Woodason, 451 E. Cambria St., Philadelphia, Pa.; Gould's Manufacturing Co., Seneca Falls, N. Y., and Robert Leitch & Sons, Washington, D. C.

Figures Nos. 1, 2, 3, 5, 6, 7, 8, 9, 10, 17, 18 and 19 were drawn under my direction by Mr. F. A. Munro, a student in the College. Figure No. 11 was obtained of Prof. A. C. True. Figure No. 4 was obtained of W. A. Lake Manufacturing Co., Harriman, Tenn. Figure No. 20 was obtained of "The Market Garden," Minneapolis, Minn. Figures No. 12, 13, 14, 15 and 16 were drawn by myself.

