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Tomatoes

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AGRICULTURAL COLLEGE
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EXPERIMENT STATION
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Horticulture and Forestry.

TOMATOES.

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33561

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All letters and other mail matter for the Station should be addressed to the Experiment Station.

TOMATOES.

LEE CLEVELAND CORBETT.

That tomatoes can not be successfully grown and ripened in the open air in South Dakota, is an idea very generally met with throughout the state. But judging from the results of our experiments, during the season of '93, there must have been some fault in the methods of culture pursued by those failing to ripen a paying crop.

There are conditions to be overcome in nearly all climates and the one here is the short season of plant growth. The past summer was perhaps one of average length, yet the period, as shown below, between frosts was too short by over a month. The time at which frosts of spring may no longer be feared is generally between May 25. and June 1. This year our plants were set in the field on May 29, and a killing frost came Sep. 15, thus giving 108 days for plants to grow and mature their fruit, a period altogether too short to expect any fruit to ripen, much less a paying crop, were the seeds planted in the open. The number of days necessary, under favorable circumstances, for a tomato to grow from seed and mature its fruit is one hundred and forty days. But since we have only about one hundred days to depend on, the deficiency must be made up. How is it to be done? Surely not by attempting to ward off the fall frosts. The other alternative then is to get the plants far enough advanced before planting them in the field to insure the maturing of the fruit.

SEED SOWING.

There are three sources from which aid in overcoming the difficulty above mentioned may be expected. They are briefly: Time of seed sowing; methods of culture and training; selection for early strains of fruit.

*This season no careful experiments were made upon the time of sowing the seed of any one variety, a line of work that will

receive attention next year, but from general observation based upon the data of the accompanying table, it is safe to say that there is a time at which the seed should be sown to get the best results.

TABLE I.—*Seed Sowing.*

Variety.	Seed sown.	Set in field.	In bloom.	Fruit ripe.
Earliest of All.....	Feb. 16	May 28	June 13	July 23
Early Advance.....	Mar. 17	May 29	June 14	July 27
Early Ruby.....	Apr. 10	June 3	July 6	Aug. 17
Red Queen.....	Apr. 18	June 8	July 21	Sep. 11

From the table it will be noted that plants grown from seed planted Feb. 16, ripened their fruit only four days in advance of another lot planted a month afterwards, while a third variety planted twenty-four days after the second was almost that number of days later in ripening its fruit. After making a due allowance for difference in variety, it would appear from this that, in general, March 15, would be a safe date, as earlier planting does not correspondingly advance the ripening season, while later planting appears to proportionately retard maturity. These conclusions are verified by experiments elsewhere.*

INFLUENCE OF TRAINING.

Three methods of treatment were decided upon as shown in the illustration. The plants used were of the same age and variety and had been given the same treatment up to the time of setting in the field. The plants of Plat I were allowed to remain upon the ground in the usual manner,—without artificial support. Those of Plat II. were trained by confining the vines within a rack two feet high, eighteen inches square at the bottom and about two feet square at the top. In Plat III. the plants were set two feet apart in the row, and trained to a single stem. All the side shoots were kept off and the main stalk was tied to a light strip of wood, one end of which was inserted in the ground, and the other fastened to a No. 12 wire that had been stretched for the purpose.

*See Cornell University Bull. 45.

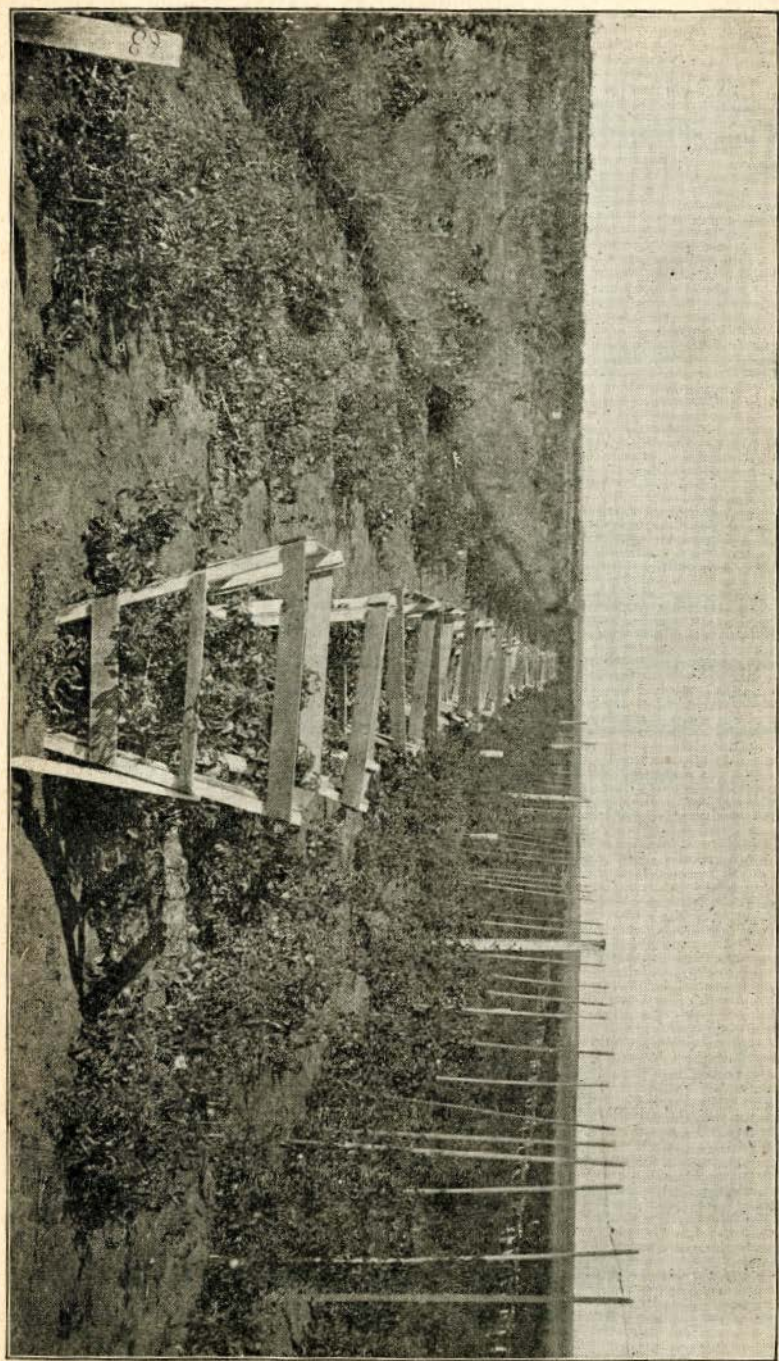


Table II. gives the average product of the various treatments, up to and including Aug. 28.

TABLE II.—*Influence of Training.*

Variety, "Early Advance."	Seed sown.	Date of first picking.	Av. No. of fruits per plant.	Av. Wt. of crop per plant.	Av. Wt. of individual fruits.
Plat No. I.....	March 17	Aug. 1	8.4	1.01	1.12
Plat No. II.....	March 17	July 27	8.5	1.07	1.20
Plat No. III.....	March 17	July 28	5.9	0.64	1.04

It shows that normal plants produced more pounds per plant than those trained in either of the other fashions described, but owing to the greater number of plants that can be grown per acre the total yield of the single stem training will be found to exceed that of the normal or rack trained plants.

TABLE III.—*Influence of Training.*—Continued.

Variety—"Early Advance."	Av. No. fruit per plant.	Av. Wt. of crop per plant.	Av. Wt. of individual fruits.
Plat I: Ripe fruit.....	50.9	5.28	1.66
Plat II " ".....	33.5	3.57	1.70
Plat III " ".....	16.2	1.32	1.30
Plat I Total (ripe or green).....	76.0	6.16	1.32
Plat II " ".....	46.7	4.25	1.55
Plat III " ".....	20.0	1.93	1.40

Table III. gives the total season's product. The part above the division line represents the total yield of ripe fruits, while

the part below it gives the total product including both ripe and green fruits. It indicates that much the greater quantity of fruit was produced by the untrained, while the largest proportion of ripe fruits, to the total yield, was produced by the plants trained to a single stem.

The accompanying table, giving the product per acre of the plants trained in the above manner, has been made up from the results of Table II and that part of Table III above the division line; and represents only the ripened product of the different periods. The first period covers the time from first ripening up to and including Aug. 28, and the second the whole season beginning with first fruit ripening and ending Sep. 23.

TABLE IV.—*Yield per Acre of Trained Plants.*

Variety—"Early Advance."	Number of plants per acre.	Yield per plant for first period.	Yield per plant for season.	Yield per acre for first period.	Yield per acre for season.
Plat I.....	2,722	1.01	5.28	54.98	287.44
Plat II.....	2,722	1.07	3.57	58.25	194.35
Plat III.....	5,445	0.64	1.82	69.69	143.75

This would indicate that during the early part of the season the single stem training gave the greatest yield per acre, but that the other systems were best for the whole season. It will be noted that twice as many plants are required to plant an acre for the single stem training as for either of the other methods, thus doubling the first cost both for plants themselves and for setting. It is a question then for each individual to settle for himself whether or not the apparent gain in early production is enough to warrant the necessary increase in cost. If land is valuable and the available area limited, then the upright or single stem system may be favorably considered for the early crop.

RIPE, SUN-RIPENED, AND GREEN SEED.

This line of work was begun last season and it was thought best to continue it, notwithstanding, the fact the field was very thoroughly worked over by Prof. E. S. Goff, of Wisconsin, while he was in charge of the horticultural department of the New York state experiment station at Geneva.*

The plants selected for this work were Dwarf Champions. The ripe fruits from which the seeds were taken were selected Aug. 18, 1892, from typical plants of the variety. The green fruits were selected on the same day and from similar plants; no fruit was taken that gave indication of color, although they were nearly full size. The others were picked July 5th, and allowed to color and ripen in the sun, they were good specimens but perfectly green at the time of picking.

On March 17. following, seeds from each of the three lots were sown in a flat so that the conditions for all should be the same. April 15. the young plants were transferred to thumb-pots, and at this time the plants from the seed of fruits matured on the vines were considered the best. No accurate account was kept of the per centage of germination for the three sets, but it was evident that the naturally ripened seed was strongest. The sun-ripened specimens stood second both in vigor of plants and rate of germination. The seed from green fruits, while low in vitality gave a sparse stand of plants that soon grew to equal the others, and at planting time, June 4, it was impossible to note any difference in the thrift of the three sets. The comparisons of Table V are based on 120 plants from naturally matured seed; 100 plants from the seed of sun-ripened fruits, and 60 from the seed of green fruits.

*New York Station 3, annual '84, p. 224.

"	"	"	4,	"	'85,	"	182.
"	"	"	8,	"	'89,	"	329.
"	"	"	9,	"	'90,	"	299.

TABLE V.—*Normal, Sun-Ripened and Green Seed.*

Variety—"Dwarf Champion."	Set in field.	First ripe fruit.	No. plants in plat.	No. fruits ripened.	Total Weight.		Average weight of fruit per plant.	Average No. fruits per plant.	Average weight of individual fruits.
					Drs. Ozs.				
Plat 1, Normal.....	June 3	Aug 10	120	1616	302	2	2.51	13.4	2.99
Plat 2, Sun ripened.....	June 3	Aug 18	100	1595	280	5	2.60	15.9	2.61
Plat 3, Green.....	June 3	Aug. 9	60	917	257	13	4.10	13.7	4.35

The above table records only the ripe fruit of the season ending Sept. 27. From this it will be seen that the plants from green seed gave the first ripe fruit, although the difference was very little in comparison with that recorded in the experiments of Prof. Coff above noted. It will also be seen that the product of the plants from green seed, for the season, is considerably in excess of the normal and sun-ripened, both in aggregate weight of product per plant as well as weight of individual fruits. The average number of fruits per plant was not quite equal to that of the sun-ripened, but considerably in excess of the normal.

At the above rates of production the different plats would have given the following yield per acre;—Plat I. 136.64 bushels, Plat II. 141.54 bushels, Plat III. 208.12 bushels, allowing the plants to be set four feet apart each way.

SEEDLINGS VS. CUTTINGS.

The tomato is easily propagated by cuttings and some growers claim that cutting plants are enough superior to seedlings to justify the trouble and expense of keeping over a few plants to take cuttings from for the early crop. If cutting plants are enough superior to justify this trouble in other localities, it is worthy of consideration here where the fruiting season is short.

An experiment along this line was undertaken, and the cutting plants were compared with seedlings of the same variety, and with the parent plant itself. Instead, however, of using plants that had been kept over, hot house grown plants of the

variety "Earliest of All," from seed, planted January 16, were used. On April 18, following cuttings were made from the leaders of some thirty good vigorous specimens and planted in the propagating bench of the green-house. The bench is heated by hot water pipes which are arranged beneath it, and is maintained at a temperature of about 65° F. The bed is composed of about three and one half inches of coarse lake sand, underlaid with about one and one half inches of clinkers. No covering sash were used, so the air about the cuttings was not close. Under these conditions the slips were sufficiently rooted in fourteen days to be transplanted to individual pots. The seedling plants used in the test were from the same seed-sowing, and were grown under the same conditions as those from which the cuttings were taken. The plants, from which the cuttings were taken, were retained and set in the field for comparison. The accompanying table records the yield of ripe fruits upon each plat of twenty plants, up to and including Aug. 28.

TABLE VI.—*Seedlings vs. Cuttings.*

Variety—"Earliest of All."	No. fruits till frost.			Wt. of fruit to frost.			Av. Wt. of fruit per plant.			Av. No. fruits per plante.			Av. weight individual fruits.		
	lbs. oz.			lbs. oz.			lbs. oz.			lbs. oz.			lbs. oz.		
Normal.....	293	38	1	1.9	14.65	2.09									
Parent	287	36	4	1.81	14.85	2.00									
Cuttings.....	479	57	13	2.87	24.00	1.90									

From this it will be noted that the cutting plants gave much the greater yield, both in number of fruits and in total weight, although the fruits themselves were smaller than those of either the normal or the parent plants. This shows that the cutting plants were decidedly earlier than the seedlings, and, at the same time more productive, a fact that could hardly have been hoped for.*

*See Cornell University Bulletin 21, 1890; 32, 1891; 45, 1892.

Table VII gives a further record of these plants carrying them to the close of the season, but recording only the ripe fruits.

TABLE VII.—*Seedlings vs. Cuttings.*

Variety—"Earliest of All."	No. fruits for season.	Total Wt. of fruit for season		Av. Wt. of fruits per plant.	Av. No. fruits per plant.	Av. Wt. of individual fruits.
		lbs. Oz.				
Normal.....	943	98		4.9	49.65	1.57
Parent.....	1533	146	14	7.3	76.65	1.53
Cuttings.....	1432	128	13	6.37	71.6	1.43

A study of this table shows that the cuttings were surpassed by those from which they were originally taken, but they maintained their lead over the seedling plants throughout the season.

PRUNED VS. NORMAL PLANTS.

It is a practice among gardeners to clip the top of tomato plants to save the labor of transplanting, and to make them shorter stemmed and better suited for planting in windy districts. What influence, if any, has this practice upon the fruiting of plants so treated?

April 18. a number of plants were pruned by cutting off some five inches of the top. Twenty of these plants were set in the field May 29, together with a like number from the same seed sowing and which had been treated the same in all respects except that they had not been cut back.

TABLE VIII.—*Pruned vs. Normal.*

Variety—"Earliest of All."	Seed sown.	First fruit ripe.	Av. No. fruits per plant.	Av. Wt. of fruit per plant.	Av. Wt. of individual fruits.
Normal.....	March 17	July 23	14.65	1.9	2.09
Pruned.....	March 17	July 28	14.35	1.8	2.00
Normal, for season.....	March 17	July 23	49.65	4.9	1.57
Pruned, " ".....	March 17	July 28	26.65	7.3	1.3

Above the division line the table indicates the yield of these plants up to and including Aug. 28, and below it that of the whole season. A comparison of the two parts of the record shows that the pruned plants received a check that they did not recover from until after August 28, but during the later part of the season they over-took and out-did the normal plants.

VARIETIES.

Little can at present be said upon the varieties best suited to our state, but the following brief list, giving the earliness and character of fruits covers the varieties under observation this year. We plan to increase the work of tomato culture along all lines next season, but particularly upon the adaptation of varieties:

Variety.	No. of days to first ripe fruit	Remark.
Early Advance.....	135	Green about stem and inclined to crack.
Dwarf Champion.....	145	Ripeus evenly, good grower, handles well.
Early Ruby.....	130	Do.
Early Minnesota.....	173	Lateness due to time of planting.
Earliest of All.....	138	Do.
Red Queen.....	147	Not quite up to standard.
Extra Early.....	160	Lateness due to time of planting. Cracks.
Yellow Fig.....	110	Small size, suited to pickling.
White Peach.....	121	Small and not prolific.
Red Cherry.....	119	Too small for profit. Early and prolific.
Yellow Cherry.....	123	Do.

ENEMIES AND DISEASES.

CRICKETS AND GRASSHOPPERS.—The fruits, after reaching full size and becoming partly colored, were in some cases attacked by the "Snowy Cricket" and eaten sufficiently to render them unfit for market. Grasshoppers were also found associated with the cricket in these injuries, but whether or not they first break the skin of the fruit is not known; certain it is, however, that both relish the succulent fruit of the tomato.

No treatment or preventative measures can at present be recommended, although several are under trial.

ROT.—During the early part of the fruiting season a small percentage of the fruits were affected with the rot (*Macrosporium, sp.*) but it was not severe enough to warrant any considerable outlay of time or money to prevent it. The short period for ripening together with this rot seem to be the only drawbacks that have attracted the attention of successful tomato growers of the state.

Upon plants trained either in racks or to a single stem the injury was less than upon those left to themselves in the ordinary manner. The disease is apparently augmented by the fruits coming in contact with the soil.

TREATMENT.—As a preventative measure train the plants so the fruit cannot come in contact with the soil. The raking and burning of all dry and decaying material in the fall after the crop has been gathered has been suggested. But since the disease works on the leaves as well as the fruit it is probable that Bordeaux mixture will be found an efficient preventative.

EDEMA.—The tomato plants in the green-house, which are being grown for the winter fruits, developed the physiological trouble described by Prof. Atkinson of Cornell University as the "Edema of the Tomato."*

In the case under consideration it was brought on by transferring the plants from pots in which they had been kept quite dry, to the fresh soil of a green house bench which was thoroughly wet after the plants were transplanted. For the pur-

*See Cornell University Station bulletin, 53.

pose of forcing them the soil was kept warm and moist, until this disease made its appearance, when the watering was immediately reduced to the minimum. In a short time the plants began to improve, but not without the loss of some of the lower leaves. As the improvement progressed the amount of water was increased in proportion to the demands of the plants.

The chief damage to the crop appeared in the fruits which were apparently rotting, and ripened some days in advance of specimens of the same cluster not so injured. The discoloration and shrunken appearance of the fruit, upon close examination revealed neither bacteria nor mycelium threads; and as it did not spread from fruit to fruit, even upon the same plant, and has not made a second appearance it must be attributed to the Edema of the fruit.

CULTURAL SUGGESTIONS.

A few remarks of a general nature may serve to bring the subject of tomato growing before you in a clearer light.

SEED SOWING.—Sow the seed, not later than March 15, about half an inch deep, either broadcast or in drills. Firm the soil well over them and moisten, maintain a temperature of about 70° F. to insure rapid germination of the seed; keep the young plants growing vigorously; transplant them often to make them "stocky," each time giving them more room. A good plan is to transplant the young plants from the seed bed as soon as they get the first pair of true leaves, setting them in pans or boxes so they shall stand nearly three inches apart. Allow them to remain in this conditions for three or four weeks and transfer to four inch pots or to old vegetable cans, from which both bottom and top have been melted. Then you have a hollow cylinder of tin into which the dirt may be packed, setting a plant in each can at the same time; allow them to grow in the cans until time to set in the field.

SETTING IN THE FIELD.—At planting time lift the cans upon a piece of tin, an old shingle or anything that can be easily slid under them to prevent the earth from being disturbed about the roots. Have holes dug to receive the plants and slip them

from the cans disturbing the earth as little as possible; if the plants have been watered four to six hours before setting, they can be removed without breaking the ball of earth. If the work is carefully done the plants will suffer none from the transfer, and no water need be used at time of planting. It is, however, better to do the work in the afternoon as the plants are thus not necessarily exposed to the sun.

If the plants are "leggy" or drawn, trim off the lower leaves leaving only about six inches of the topmost part bearing leaves. Set the plants, thus treated, in a trench about six inches deep at one end and eight at the other, making it in the direction of the row and of a length sufficient to receive the plant. Place the ball of earth upon the roots of the plant at the deeper end of the trench and allow the top to project above ground at the other, draw the dirt over the plant in this condition and the operation is complete. The advantages gained by this treatment are that a greater root system is soon supplied to the plant, because the portion of the stem buried in the trench will soon take root. A second, and perhaps greater, advantage is that the leaf surface is greatly reduced and only a small portion is thus left exposed above the surface of the ground. Plants thus treated need no protection and are not broken by the wind. The damage by the wind is one of the great drawbacks to setting large plants, but this method will overcome the difficulty and will not retard the maturity of the fruit.

CULTURE.—Clean culture is the next important requirement to success and rapid growth. Cultivate shallow, not more than two inches deep, and as often as once a week. This accelerates growth and tends to reserve the moisture of the soil by preventing evaporation.

SUMMARY.

1. There is not enough gain to warrant the additional trouble and expense of sowing tomato seeds before March 1, and for the ordinary field crop they should not be planted later than the middle of March.

2. Single stem training makes the crop earlier but reduces the quantity materially.

3. Seeds from green fruits gave larger fruits and a greater weight of fruit per plant than sun-ripened or normal.

4. Cutting plants are decidedly earlier and more productive during the early part of the season than normal or parent plants.

5. Pruning plants before setting in the field retards maturity of the fruit.

6. The three best varieties tested were Dwarf Champion, Early Ruby, and Early Advance.