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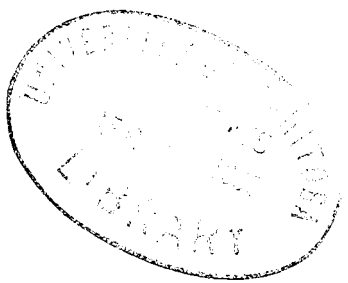
THE TOMATO INDUSTRY OF THE ARKANSAS VALLEY.



—BY—

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THE TOMATO INDUSTRY IN THE ARKANSAS VALLEY.

BY H. H. GRIFFIN.

There are five factories in the valley devoted almost exclusively to canning the tomato. A successful pack for them means a considerable revenue to the farmers. The production of this crop has not been attended with uniform success. To get the best results has been a perplexing question, both to the farmers and to the factory operators. Poor success with this crop cannot be ascribed to diseases or insect pests, for neither caused any serious loss.

One complaint has been that the vines would grow large but fail to set fruit in sufficient quantity. Another, and more prevalent one, was that the vines would be well filled with fruit but too late to mature before injurious frosts. Most of the time the result has been that the major portion of the growers were disappointed in the returns from the crop, and the factories have been without a sufficient supply to operate profitably.

The writer was of the opinion that the troubles of the tomato growers were not entirely due to difficulties of soil or climate, but rather to the lack of a well defined system of propagation and cultivation.

To throw some light on this subject a systematic study of this crop was begun and the results of three years work are embodied in this bulletin.

The tomato is a native of tropical America where it was cultivated by the natives before the continent was discovered. For many years it was cultivated in this country and in Europe as an ornamental plant. It was considered poisonous, and went by the name of "Love Apple." It began to be used for food in some places about the beginning of the last century, but as late as 1832 it was considered a curiosity in New England. The value of the crop in the United States is now several millions of dollars annually. Tomatoes are now put on the

market in many forms and are considered an indispensible article of diet. About 300,000 acres are devoted to the growth of this crop in the United States, and the pack averages about 5,500,000 cases.

Productiveness of the tomato in the northern states, is largely a question of early bearing;—this is especially true at our altitude, where the season is comparatively short. The plant will outlive the seasons of the north, hence its life is determined by the contingencies of frost rather than by any inherent limit of duration. It does not mature at our altitude and it would probably continue to bear for some months if not frosted. It is apparent that all advantage possible must be taken of that portion of the season most favorable for its fruiting. That the lack of success in the Arkansas valley is not altogether a matter of seasonal difficulties is evident when we compare results with those in northern Colorado, one thousand feet higher, where the canneries are uniformly successful. In some parts of this district the yield averaged fourteen tons per acre in 1901. The product was so large that the canneries were unable to handle the acreage contracted.

I have ample reason to believe that aridity is an important factor in determining the yield of this crop. And another factor, no doubt, is the prevalence of strong winds or dashing rains at the period when the plant is blooming profusely.

Dropping of the bloom is quite a familiar occurrence. Often whole clusters drop, leaving not a single flower to produce fruit. As the tomato is a native of a warm, moist climate, it is apparent that dry, windy conditions, followed by cold nights, are not favorable to the pollenization of the flower and the setting of the fruit. For this reason every possible advantage must be taken of the growing season, so that if the bloom fails to set at one period there will be ample time to secure good results later. This principle is often well illustrated with the cantaloupe; a crop which there can be no doubt is adapted to this section. Cold, windy conditions may prevent the pollenization of the flowers for a short period and the result is that the fruit fails to set. This will be noticeable during the growing period. The yield is lessened thereby, and is especially noticeable if the plants are rather late ones so that the shortage may not be made up by later favorable conditions. It is reasonable to assume that the same condition holds true with the tomato.

It is common practice to plant the tomato on impoverished land or on land quite sandy, where it would not be expected to get good returns from most other crops. The opinion seems to be wide spread that a well enriched soil is positively detrimental to the tomato.

Tomatoes yielding six tons per acre will take from the soil 25 lbs. of potash, 18 lbs. of nitrogen and 8 lbs. of phosphoric acid. The vines will require 34 lbs., 28 lbs. and 4 lbs. respectively. A crop of tomatoes removes twice as much potash and over fifty per cent. more nitrogen than either a crop of Irish or sweet potatoes. Thus we see that the tomato, contrary to opinion, is a gross feeder. It may appear as composed mostly of water but there is an immense seed production that demands considerable fertility.

Prof. Bailey, of New York, after experimenting with fertilizers for this crop a number of years has the following to say:

"It is a common belief that the tomato, unlike most plants, is not benefitted by rich soil or heavy manuring. Our tests give uniformly heavier yields in heavily fertilized land. There is some reason for the widespread belief to the contrary. Much may depend upon the soil and still more upon the character of the fertilizer. It should be one quickly available to the plant. Fertilizers that give up their substance late in the season give poor results because they delay fruitfulness.

Prof. Earle, of Alabama, says there are but few soils in that state rich enough to grow satisfactory crops of tomatoes without fertilization. The following conclusions are drawn from careful experiments in New Jersey.

"That nitrogen is an important element in growing tomatoes. With sand, the increase in the use of nitrate is nearly five times that with minerals only. That a full supply of nitrogen is more effective on a sandy than on a clay soil."

Growers of tomatoes in Mississippi use on fairly good land, 400 lbs. of cotton seed meal, 400 lbs. of acid phosphate and 100 lbs. of Kainit per acre.

All of the above places have conditions naturally more congenial to the tomato than are our conditions. The season is much longer, the nights warmer and yet we see how essential they consider it to push the plant forward.

EXPERIMENTS IN 1900.

The Perfection and the Stone were the varieties used in the trials. The seed was put in the hot-beds about the first of April, intending to have the plants ready to set in the open field about the 10th of May. It was not the intention to do any transplanting. The soil

was as nearly uniform in quality as possible to get. For two years the greater portion of it had been fallow, the remainder in bluegrass. No fertilizer was used.

May 8th, two rows, (one of each variety,) 140 feet long were planted to the seed in open field. May 9th and 10th ten rows, (five of each variety) were set with plants from the hotbed. They were to receive treatment as follows: One row to be pruned while the plants were small; one after the plants were well advanced. The plants in another row were to be transplanted after growing sometime in the field. Two rows were to be grown according to usual practice as a check upon the results. The plants used in this work were of medium size, taken from the original bed; the kind of plants that are commonly set in this valley. May 28th, one row of each variety, was set with the same class of plants for a comparison of late planting.

We thus had the following questions under consideration:

1. Plants started in the open field compared with plants set from the hotbed.
2. The effect of early trimming.
3. The effect of late trimming.
4. The effect of transplanting after growing for a time in the field—whether or not it would retard growth and hasten ripening.
5. Plants set late in May compared with those set early in the month.

The early pruning was done June 19th, 28th and July 9th. The late pruning was done August 9th and consisted of a shortening in of the side shoots and tops of the vines.

The Perfection gave the first ripe fruit August 9th, from one of the check rows. The first ripe fruit was taken from the Stone and from the check row August 24th.

The plants of the Perfection, set in field May 28th, did not ripen fruit until September 3rd. The other plantings, except seed in the field, were yielding considerable fruit by the first of September.

The following table gives the yield per hill of each row:

	Perfection. Lbs. per hill.	Stone. Lbs. per hill.
Seed in field	2.6	1.5
Early pruning	3.9	3.1
Late pruning	4.4	3.3
Field transplanting	4.7	3.2
Late setting	3.0	1.4
Check row	4.2	2.7

A yield of six tons per acre is represented by about 4.5 lbs.per hill.

The Stone did not bear much until the first week in September. All of the plantings were then yielding ripe fruit except that made May 28th, which did not bear until September 18th.

It should be noticed how uniform was the yield from all the plantings made early in May. The plants set late in May yielded about the same and commenced to bear about the same time as the plants grown from seed.

I had under observation one field in which considerable pruning had been done, but there was no benefit derived.

The work of the season was intended to be largely of a preliminary nature, the press of other work not enabling us to take up the question extensively. It should be noticed that the work was to test whether those ideas popularly held were true, i. e.—that the plants grew too much to vine at the expense of fruit.

From the results of the year it was quite evident to me that a lessening of the vine was of no benefit. It was also evident that late set plants were of but little value.

SEASON OF 1901.

The work of this year was along different lines from those of the preceding year.

It embraced two distinct lines. 1. Experimenting along certain lines at the station. 2. Observations, among the growers, of the methods employed and the success obtained.

The work of the station was planned as follows: (*a*) A comparison of different classes of plants, also a comparison of the time of setting in open field as affecting maturity and production. This included the use of transplanted plants (very stocky,) set early in open field. Also plants, not transplanted, set in open field early and late, and plants produced from seed sown in open field. (*b*) The yield and maturity of plants compared when grown on land heavily manured, (barnyard manure well rotted,) with land having no fertilizer. (*c*) Variety tests. The work was badly handicapped by a hail storm on the 24th day of July. For a time it seemed as though the results for the season would be destroyed. Owing to the effects of the storm, only general results can be given, but the facts are sufficiently clear to warrant the conclusions, verified as they are by the results of others.

The seed of a Beauty tomato was sown in hotbed March 2nd, and plants from this sowing transplanted to

another bed April 13th. Seed was again put in hotbed the last of March to get plants for later setting.

April 19th, a planting of seed was made in open field. Irrigation was at once employed to germinate the seed and the plants were showing by the 30th of the month. It is not often safe to have plants in open field as early as this. This planting was made on land well enriched with barnyard manure.

April 24th, twenty very early plants were set in open field on the same land as above. They were large, lengthy plants, what might be called "leggy." May 7th and 8th a considerable planting was made of plants from the hotbed. It consisted of transplanted plants (strong and stocky,) set on heavily manured land. The same kind of plants were also set on land having no fertilizer. Untransplanted plants were also set on both the fertilized and unfertilized land. Thus on the manured land were four classes of plants. May 3rd, a planting of seed was made on unfertilized land.

May 8th, on unfertilized land, some very small plants (smaller than those above mentioned) were set, and on the 16th of May, still another planting was made. About one acre of land was used in these trials.

By June 15th the bloom was plentiful and small tomatoes had formed on the transplanted plants growing on the manured land. By the middle of June all of the plants on the manured land were blooming well, but those on unfertilized land contained but few blossoms. The first fruit was picked July 16th from the transplanted plants growing on the manured land.

At the time of the hail, July 24th, all of the plants, except those set May 16th, and those grown from seed planted May 3rd, had set some fruit. Much the best set being on the transplanted vines on manured land.

The first ripe fruit from the plants grown from seed on manured land was picked July 29th. This was about two weeks later than from transplanted plants. It was August 23rd before any ripe fruit was taken from the plants set the 16th of May, more than a month later than the first ripening. The last of August the plants on the manured land were yielding fully twice as much fruit as those on unfertilized land. The early plants were yielding much better than the late ones.

It was the middle of September before fruit in any quantity was taken from the plants grown from seed planted May 3rd, or from the planting of May 16th. Just

what effect the hail may have had upon the various dates of ripening cannot be told. The total yield of perfect fruit was light. It was the intention to have a record of each planting, but it was found it would reveal nothing owing to the injury of so much fruit by hail.

Close observation was kept of some tomato fields, especially of such as were apt to give some data along the lines we were studying.

March 3rd, Mr. J. H. Crowley put tomato seed in hotbed and transplanted to boxes in another bed April 2nd. These boxes were made of building paper by cutting the desired size, folding and tying with a string. The boxes were left on the plants when they were put in the field. The plants were set in open field May 14th, at which time they were more than a foot in height and blooming some. Part of them were put on land that had been fertilized with nine loads of sheep manure per acre. The other portion was put on the same kind of soil but having no fertilizer. The first ripe fruit was taken from the vines on manured land July 4th, about three weeks earlier than the others. Mr. Crowley estimates the yield from the manured land as being about 60 per cent. the greater. Wherever the manure was applied there was an immense benefit, apparent in the size of the vine and the amount of fruit.

Messrs. Fullmer and Sanders had about four acres of tomatoes on alfalfa sod. They made their first planting in open field about May 10th. Some of the plants were potted but the greater portion were from the original bed. The first ripe fruit was taken July 8th, from the potted plants.

The last week in May another portion of the field was set with plants from the original bed. From this planting the first ripe fruit was picked the first week in September. There was a difference of only three weeks in the time of putting the plants in the field, yet there was seven weeks difference in the period of ripening. The early planting yielded heavily and by the first of October was still yielding as well as the later planting. Thus we see the tomato will bear a long time if the ertility is present to support the plant.

From the field about 40 tons of fruit was sold, 34 tons going to the cannery. It was estimated that the yield from the first setting was 12 tons per acre, and from the late setting 8 tons per acre.

The last picking was made October 20th, at which

time there were immense quantities of green fruit on the plants set late in May. If frost had come as early as usual these plants would not have made the returns they did. This is quite a striking example of the benefit to be derived from the use of strong, early plants. This was the finest field of tomatoes I had yet seen in the valley. If it were true that a heavy nitrogenous fertilizing would produce vine at the expense of fruit, we would expect to see such results in this instance. On the contrary, we find this field yielding double, and often treble, what many other fields did in the vicinity.

Another striking example of the benefit derived from the use of manure was on the farm of Mr. Foster, Manzanola. His land is quite sandy, consequently it gets very hot during the summer. Part of his tomato land had been manured quite heavily. The same class of plants were used throughout and the planting was done at the same time. The plants on the manured land grew large and thrifty and made a good yield. Those on unfertilized land were small, unthrifty and many blighted. The yield was not sufficient to warrant the labor expended.

SEASON OF 1902.

This was largely a continuation of the work of 1901. However, more time was given to observing the work of different growers, especially in the vicinity of Manzanola. Mr. Barton, of the Manzanola Canning Co., was much interested in the effort to improve the industry and extended many courtesies.

The work on the station land comprised the following:

1. Comparison of plants grown in the field with those from the hotbed.
2. Comparing transplanted plants with those not transplanted.
3. Comparison of land well fertilized with land not fertilized.
4. Comparison of early and late plants.

April 26th, seed was sown in open field on land heavily manured with rotted barnyard manure. Speedy germination was secured. Adjoining these were set, on May 7th, thirty-five long spindling plants taken from the original bed. They were from a bed made early in March. Adjoining these were set, on the same date, seventy plants taken from the same bed but which had been transplanted a short time. There was but little difference in the appearance of the plants from the two sources. The plants were purchased for the purpose of making the comparison. Next to the above were set transplanted plants that were of nice size, strong and stocky. They

were from a bed made early in March and transplanted to another bed about the middle of April. Some plants of medium size, considered of medium quality, were taken from the original bed and set at the same time (on manured land) as those above mentioned. The latter class of plants were also put on adjoining land that had not been fertilized. The plantings to this time comprised 27,160 square feet of land.

May 14th, we set in open field some small transplanted plants together with some from the original bed. These were small plants but as good as many that are used every year by those growing for canneries. May 26th, another planting was made with plants from the original bed. These plantings were made on land that had received no fertilizer for years and comprised six-tenths of an acre.

After the setting of the plants, irrigation was given two or three times until the plants were well established, after which they were thoroughly cultivated and hoed. The next irrigation was June 18th. It was again irrigated commencing July 15th, and the water was last applied the 20th of August.

The first ripe fruit was taken July 25th from the stocky transplanted vines set on the 7th of May. In a few days the purchased plants and the larger ones from the original bed were also ripening fruit.

August 10th, 13 lbs. of ripe fruit were picked from the former vines, on the 20th, 54 lbs. were picked and on the 22nd, 137 lbs. From this time this class of plants were yielding in such quantity as to warrant picking and delivering to a canning factory. The plants put in the field May 14th were not setting fruit until the last week of July, at about the same time the transplanted plants on manured land were ripening fruit.

The first to ripen of the May 14th planting was the transplanted vines, August 25th. The plants put out May 26th did not ripen fruit until the first week of September.

August 25th a few ripe tomatoes were taken from the plants grown from seed (planting of April 26th.) As in 1901, plants grown in this way ripened their fruit about the same time and yielded about the same as late plants from the hotbed. If the season is favorable and the conditions are such as to push the plant, ripe fruit can be secured in time to get fair returns. The fruit picked from the vines set on May 7th amounted to 7,487 lbs. or, at the rate of about six tons per acre. The greater portion was picked

before frost became severe enough to seriously injure the fruit. The yield would have been larger had the seed been true to name. It was purchased for the Beauty but the product resembled the Acme more.

The equal area set May 14th, yielded only 2,550 lbs., or, at the rate of 4,250 lbs. per acre. The difference in the yield of the two plats can be attributed to the difference in fertility, the class of plants used and the time at which they were set. It can be attributed mostly to the first two causes, as there was a difference of only one week in the planting, but nearly a month in the time of ripening. The greater portion of the yield was secured after severe frost and the fruit was more or less injured. The results are in harmony with those secured by other growers.

A factory with a considerable acreage, similar to the early ones, could begin to pack by the 20th of August. September would be well advanced before packing could commence if the acreage corresponded to the last can. The tonnage would not be sufficient nor the quality satisfactory. The grower becomes discouraged and is slow to again venture in the business, preferring to put his land to some crop in which the returns are greater and surer.

THE FIELD OPERATIONS.

It is difficult to draw conclusions from this work for the reason that in but few cases can comparisons be drawn. The class of plants used, the kind of soil, the time of setting, attention given, and fertilizer used, seldom enable any comparisons to be drawn. Hence it is difficult to get very much reliable information from a vast amount of this kind of work. One little experiment where the conditions are under control is apt to be worth much more than the observation of many conditions of which we know but little.

Probably the best crop of tomatoes grown in the valley this year was that of Mr. H. W. Harlow, near Manzanola. From 1¼ acres he took 18 tons of tomatoes. The soil on which the crop was grown had supported cottonwood trees until two years previous. The location was in a swale, the soil naturally quite rich and enriched by the addition of much vegetable matter from the tree leaves, etc. The land was fall plowed dry, turning up in large prices. The planting was done about the middle of May with plants from the original bed, the plants were of good size, thrifty and forced from the start. Mr. Har-

low states that he replanted some missing hills in June but at picking time could discern no difference. This, I think can be accounted for from the fact that the vines were extremely large, very closely planted together and difficult to tell one plant from another. The rows were four feet apart and the plants 3½ feet in the row. One plant occupied about 14 square feet of land, hence an acre contained about one-third more plants than are ordinarily grown. The fruit was a very fine specimen of Beauty, which augmented the yield. A portion of the plants were from seed saved by Mr. Harlow. The vines were so large and so thickly covered the land that the first frosts did them but little injury, in fact, rather aided the ripening. The first delivery to the factory was made August 27th, but the heaviest yield was from October 11th to 23rd. Thus it is seen that the field was not an early one, which could not be expected from the class of plants used. The conditions in this field are such that no comparisons can be drawn, but it is of interest by reason of results secured.

The field that gave the most promise early in the season was one of about 14 acres, most of which was alfalfa sod. Many of the plants used were grown as follows: The seed was put in hotbed the middle of February and transplanted to a muslin covered bed with under heat (manure) in March. The tops were clipped to make the plants stocky. They were set in open field about May 10th; strong and stocky with a splendid root system. Some of the plants from the original bed were also put on the alfalfa sod. These were also good plants with good root systems. On some cultivated land near by some of the late plants were set; small, weak plants compared with the others. Owing to the scarcity of water, this field could not get the desired attention. It was in an exposed location and a severe wind about July 20th, did it much damage. At this time all of the plants on the alfalfa sod were large and thrifty and appeared to be well set with fruit. The late plants were small and no fruit had set. On August 16th I took particular note of the amount of fruit on the transplanted vines and those not transplanted, both on alfalfa sod. It was estimated the former were supporting nearly twice as much fruit as the latter. Ripe tomatoes were picked from this field August 1st. About the 16th of the month from 150 to 200 lbs. was being picked every other day. Delivery to a factory could have commenced by August 20th. As heavy

returns were being made to the factory during the last week of September, as at any time during the season. It was one of a few fields to make its heaviest returns prior to October 1st.

This field suffered for water the whole season, but especially during the latter part of July when water was demanded the most. It can be truly said that the scarcity of water was responsible for the light yield which this field gave. The late set plants gave no returns. The comparison that could be made here showed the superiority of the transplanted plants.

Another field, to which particular attention was given, was one of about three acres on very sandy land. About two-thirds of it had been manured with unrotted sheep manure. The plants were from the original bed and of fair size, set in open field about May 20th. There was a portion of the field set about two weeks later than the above. About July 20th the early plants on the manured land had considerable fruit of good size and it was still setting. The plants set later were much smaller and were just commencing to form the fruit. By the last week in August the vines on the manured land were large and thrifty, well set with fruit. They had been yielding some ripe fruit for nearly a month. Delivery to the factory was made at the time of opening, August 25th. The yield was 30,194 lbs. besides much shipped to market. The heaviest deliveries were made about September 20th. The vines on the unfertilized land gave much the lighter yield and were about three weeks later ripening. Water was used in abundance but this was made necessary by so much dry heating material in the soil. As an instance of what early planting and good plants will do, we record the following: The above grower had a few good plants set in the garden in April and protected for a time from frosts and winds. These plants ripened fruit July 20th and bore well for the season.

Special mention might be made of many fields but it will suffice to give a general account of results. In nearly every instance when small plants were set rather late in open field, and especially on land given no special preparation, fruit formation did not commence until about July 20th. From observation made this season it is found that the time required to ripen the fruit after formation is from forty to fifty days. This was true of the first fruit that formed. If the forming of the fruit is delayed until the 20th of July there will be none ripe before the first of

September and the greater portion of it will not ripen until about October 1st. It can be readily seen what an advantage there is in having the fruit ripening by the last of July. It means that the heaviest deliveries can be made about the middle of September, before frost does serious injury to the tomato, thus insuring a good uniform pack with much less loss than in the late one.

After the middle of September, the nights begin to get quite cool and usually the tomato ripens slowly.

The results as a whole indicate that soil conditions play considerable part in tomato growing. The tomato seems to prefer a virgin soil, and a sandy soil is preferable to a clay. Considerable adobe is not desirable.

Increase in vigor and productiveness evidently are closely associated with careful handling and good tillage. There can be no question that transplanting, properly done is invaluable. *Stocky plants*, vigorous and growing well *are better* than simply early plants. This was plainly shown in our tests of 1902. On the other hand, transplanting does not avail anything over early plants well grown unless the transplanting is done a sufficient time to increase the root system of the plant, together with its strength and general vigor.

Good healthy plants started medium early and kept growing vigorously are preferable to early plants allowed to get too thick in the bed, which causes them to become spindling and stunted in their growth. They are also preferable to a transplanted plant that has been stunted. A good tomato plant, at time of setting in the field, is one which is stocky enough to hold the weight of itself, together with a considerable amount of dirt, about the diameter of a lead pencil and 6 to 8 inches in height. A tall. weak plant is not worth setting. The desirable thing to secure in this country of short seasons and cool nights is a plant having age. It stands to reason that the older the plant the sooner it will commence to bear—it takes about so long for a plant to come to the bearing age. The most successful way to accomplish this is by transplanting. If this is not done care should be exercised that the plants do not become crowded and "leggy" before time of setting.

We must bear in mind that the tomato will not give profitable returns without more care in the selection of seed, plants and soil than is given most of our staple crops. Special preparation must be made for the crop. A small acreage grown under the most favorable conditions is

worth more than many times the same amount put in and tended in a haphazard way.

VARIETIES.

During the season of 1901 the writer had under trial or observation with different growers the following varieties: Magnus, Success, Burpee's Combination, Enormous, New Large Early, Fordhook First, Fordhook Fancy, Quarter Century, Acme, Tall Queen, Ruby, Dwarf Champion, Kansas Standard, Perfection, Matchless, Truckers' Favorite and Beauty. Of this list there are but few that seem to have any merit for this country. For canning purposes, where it is necessary to combine earliness, appearance, quality and productiveness, the Beauty easily takes the lead. The factories recommend this variety. It is also a splendid shipper. The Acme is a little earlier and for early shipping to markets may be preferred to the Beauty. The Fordhook First is also a good early shipper. During the past season there was much loss occasioned by the failure of plants to bear fruit typical of the Beauty. It was a great disappointment to have the yield so materially reduced and it was a source of loss both to canner and grower. Seed selection has never been given proper attention by the growers and it is one reason why success is not oftener obtained. The tomato is one of the most variable and inconstant of garden plants. Authorities say that varieties of tomatoes as a rule are short lived and that ten years may be considered the profitable life of a variety. Many of us are aware that old standard sorts are now extinct.

To illustrate this I wish to quote from Bulletin 32, Bailey & Lodeman, (October 1891) of the New York Experiment station, under the heading of "Do varieties of tomatoes run out," it has the following:

"For some years it has been apparent to the writer that varieties of tomatoes run out or lose their distinguishing characters. The reasons for this loss of varietal character are not necessary now to discuss. Crossing, no doubt hastens it in many cases. But it is well to state that running out does not mean deterioration simply, but disappearance of characters by whatever cause. Studies of this question were made this year by growing the same variety from many seedmen. This gave us an opportunity to determine if the variety had varied greatly in the course of its history, or if all seedmen really sold the same thing under a given name. In order to determine how long a variety may persist, we selected Grant and Canada Victor, which are old varieties; and to find how soon a variety may depart from its type we grew the Ignotum."

"Grant was obtained from seven seedsmen,—all who catalogued it. Of these seven samples, but two were true Grant as the variety was recognized years ago. The remaining five samples grew fruits

of various kinds, although somewhat resembling the Grant type. It may be said that these variations were due simply to mixing of the seeds during a number of years by careless handling, but there is reason to suppose such is not the case. The Grant has a peculiar small, slightly curled, light colored foliage and a well marked upward habit of growth of the young shoots. These characters appeared constantly in all the samples. The foliage, being less variable than the fruit and not an object of selection by the horticulturist, had remained constant, while the fruit had lost its character."

"Canada Victor was grown from ten seedsmen. There were none which could be recognized as true Canada Victor, but they were all small, variable, irregular and practically worthless. Yet in all the samples, the peculiar, slightly curled foliage of the Canada Victor was apparent."

"Ignotum was obtained from fifteen dealers. This variety was first offered by seedsmen in 1890. Of the fifteen samples, eight gave small and poor fruits, which were not worth growing and could not be recognized as Ignotum by any character. The other samples were fairly uniform and represented a medium type of Ignotum.

"Ignotum grown from one of our own savings gave a number of plants which bore inferior fruits, although clearly Ignotum. It is difficult to suppose that in one season a variety could so far have lost its characters that one-half the seedsmen should offer inferior stock of it. The variety is well fixed, for in one of our large plantations of it, it was remarkably uniform and equally as good if not even better than two years ago."

DISTANCE TO PLANT.

The vines should be sufficiently close to shade the ground during a portion of July and August. The heat and reflection of the sun from our light colored soils often have an injurious effect upon the tomato plant. On well fertilized land I would recommend that the plants be set about 4 feet each way. That it is none too close we have good evidence in the field of Mr. Harlow, previously noted. His plants were even closer than this and yet he got more fruit on one acre than many secured on four acres.

The sun and heat evidently cause physiological troubles, which growers often include under name of blight. A familiar trouble of this kind is a blackened condition of the plant, or portion of it, late in the season. This is quite prevalent on light, sandy soils where the plants are small and exposed.

The trouble first manifests itself on the south-west side of the plant. I have never seen it when the plants were large and covered the ground. The plants have been examined for fungi and bactria by competent persons but none have been found present. It seems to be physiological trouble caused by excessive heat. Blistering of the fruit is quite a common occurrence when it is exposed and is often a source of considerable loss. It

well illustrates what a powerful effect the sun has upon exposed vegetation.

Another disease is sometimes present which is commonly termed blight. It has been described as caused by bacteria and very much resembles the field or southern tomato blight. It first manifests itself by the top leaves folding together and turning yellow. It gradually destroys the leaves downward, the first affected leaves dying. Finally the stem turns yellow and the plant slowly succumbs. Exposure to the reflection of the sun's rays from light colored soils seems to favor its development. This was well illustrated in 1901, where a grower had trained about one dozen vines to stakes and kept them pruned up high according to the practice in the southern states. Every one of these plants were destroyed by this disease and much of the fruit that formed was blistered. By the side of these plants about one-eighth of an acre of tomatoes were set out at the same time but which had grown sufficiently rank to cover the ground. There was no sign of the disease on these plants, the fruit was not injured and the yield was good. This disease was reported by the writer in New Mexico bulletin No. 21. It was found there that the disease was much worse on the light sandy soils than on the dark colored bottom lands.

The fruit of the tomato is occasionly affected by what is commonly termed blossom end rot. This is a blackened condition of the blossom end which gradually enlarges until the tomato is destroyed. There is no efficient remedy known. It is possible that a too free use of irrigation water late in the season may increase it.

IRRIGATION.

The tomato does not require an abundance of water but it requires a constant and uniform supply. The most water should be applied when the fruit is forming, when the vines are in bloom quite well. As soon as the plants have become established, only sufficient water should be given to keep them growing nicely. This is the time the cultivator and hoe are demanded. The growth of the tomato is of a succulent nature and should not be forced too much by a plentiful supply of water in its early stages. The result of so doing will be a tender growth of a yellowish color instead of a healthy green, forming wood instead of fruit buds. If the water is withheld until the bloom is well started, a plentiful supply will aid the setting and growth of the fruit. However, it should not be

applied too late, as after the nights become cool watering may retard the ripening.

In the Holbrook country this season were some good illustrations of the drouth resisting power of the tomato. The last of August I saw large thrifty vines that had been watered but twice, once at the time of putting in the field and again the first week in August. Where the best results were secured the land was very retentive of moisture, as was also the subsoil, which furnished a small but constant supply. Some of these fields gave promise of ripe fruit by early September, yet tomatoes were not marketed in quantity until about October 20th.

INSECTS.

There are two common insects which trouble this crop every year, viz: the tomato worm, (*Protoparce celeus*) and the corn or boll worm, (*Heliothis armigera.*) The former is very easily controlled by spraying, yet it is surprising how few growers utilize any means of this kind, but will put in much time destroying the worm by hand. Any of the poisons as commonly used for spraying apple trees will be effective against this worm. The best material to use is the arsenate of lead for it will not injure foliage, no matter in what strength used.

The latter is the larva of a night flying moth. There is no very successful way known of controlling this insect. It is sometimes recommended to plant sweet corn near the tomatoes as a trap crop. We tried this remedy this year with considerable success. It can be said that those growing near the corn were nearly free from worms, while those at a distance were injured to a considerable extent. Three successive plantings of corn should be made, the first at the time the tomatoes are set. Each planting should be disposed of before the worms get large enough to leave the ears. The Hazeltine moth trap was tried during the season of 1901 to note if the extent of injury could be reduced by this means. The trap was set two or three nights in a week and the catch sent to Prof. Gillette for determination. We failed to catch a corn worm moth during the season.

THE SAVING OF SEED.

A few instances have come under my observation where splendid success was obtained from the use of home grown seed. The fruit was large and typical of the

variety. A portion of the crop grown by Mr. Harlow was from seed of his own saving. Too often purchased seed is not what it is recommended; it may be (for all the purchaser is aware) the refuse from canning factories. It would seem the wise thing for our growers to save their seed from perfect specimens.

PROPAGATION OF THE PLANTS.

Every grower of tomatoes should be prepared to grow his own plants and these of the finest quality. By so doing he has the plants at hand to put in the field, without any deterioration in quality, when the soil is ready and the water at hand. To get the best results, the soil for the bed should be prepared by composting. It is not essential that glass should be used, but it is preferable for starting early plants. Canvass requires considerable more care and labor in affording additional protection. Furthermore, it requires considerable more bottom heat as there is not so much heat secured from the sun. In times of bad weather too much shade may be the result with canvass, causing the plants to grow too spindling.

When plants are started in February or early March, glass should be used. Before they become large enough to crowd (in early April) they may be shifted to a canvass covered bed.

CONCLUSIONS.

1. Some good crops have been grown every year and if proper methods are employed good results may be secured by a large majority of the growers every year.
2. Seed of known quality must be used.
3. Proper selection of varieties is essential.
4. The plants must be started early so as to give them age, strength and a good root system.
5. The plants should be thrifty and set in open field as early as frost will permit.
6. Sandy or loamy soil is preferable but it should be well fertilized with some quick acting fertilizer; that a virgin soil and alfalfa sod give good results.
7. A constant and uniform supply of moisture, but not too abundant until the blooming period is well started.
8. Close planting that the ground may be shaded to avoid injury to vine and fruit.
9. The tomato is a valuable crop with which to subdue alfalfa for succeeding crops.
10. The crop should be ready for canning fully three weeks earlier than has been the custom, thus insuring profit to the grower and the packer.