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Economic Results in the Pollination of Greenhouse Tomatoes

By

A. G. B. Bouquet, B.S.,
Horticulturist (Vegetable Gardening)

CORVALLIS, OREGON

SUMMARY

1. Early investigations concerning the economics of hand pollination were published in Oregon Experiment Station Bulletin 158, now out of print.

2. The present circular summarizes the principal results of these investigations besides adding further data.

3. Yields of tomato plants as reported from growers average 5 to 8 pounds per plant.

4. It is possible by means of hand pollination materially to increase the above-mentioned yield as is shown in the discussion.

5. Yields of 204 experimental plants, observed in 4 blocks of 51 plants each, show a striking uniformity, cultural conditions and hand pollination methods being similar throughout.

6. The average yield per plant in all of the blocks was 11 pounds, 5 ounces.

7. The average number of fruits produced per plant was 29.

8. The average weight per fruit was 6.2 ounces.

9. Three pounds, 2 ounces, representing 27 percent of the total amount of fruit per plant, were produced during the first period; 7 pounds, 11 ounces, or 68 percent, were harvested during the second period; 10 ounces, or 5 percent, were picked during the final period.

10. High yielding tomato plants, capable of producing an average of 14 pounds, 12 ounces bore 39 fruits apiece, or 22 fruits more than the average of low yielding plants.

11. Low yielding plants, producing an average yield of 6 pounds, 9 ounces, bore 17 fruits apiece or 4 pounds, 12 ounces less than the yield of all plants, or an 80 percent loss compared with the average of all plants.

12. Pollination influences earlier maturity of fruit. An average of 16 plants yielded 53 percent of the total during the first harvesting period during which prices are highest.

On the other hand, where blossoms dropped from the early formed clusters, only 15 percent of the total yield was harvested during the first period.

13. Under normal pollinating conditions about 64 to 70 percent of all blossoms will produce marketable fruit.

14. The fruiting of over 1,100 clusters representing 9,473 blossoms has been under observation. The total number of actual flowers produced on an average of the 1,100 clusters was 8.4, of which 5.4 produced fruit and 3.0 were unproductive. This represents a percentage of 64 and 35, respectively.

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INTRODUCTION

Earlier investigations in regard to pollination of greenhouse tomatoes were published in Oregon Agricultural Experiment Station Bulletin 158, March, 1919,[3] bringing the literature then available on the subject as far as possible up to date. This bulletin has since been exhausted, occasioning the preparation of the present circular, which briefly summarizes the most important findings in Station Bulletin 158, as well as other phases of the economics of pollination as it directly relates to profit and loss in growing greenhouse tomatoes.

The following important points in the summary of Bulletin 158 are here stated, connecting them with the phases of the work presented in this circular:

(1) Commercial greenhouses have produced large numbers of tomato plants which bear many barren or unfruitful blossoms, the proportion of unfruitfulness often being as high as 60 to 70 percent of the total number of blossoms, thus causing considerable financial loss.

(2) One tomato crop under observation, the plants of which were unpollinated, gave 60 percent of the blossoms unfruitful, the average production of the fruit for each plant being 3.3 pounds.

(3) There are several causes for the unfruitfulness of blossoms: first, the absence of natural pollinating agents such as insects; second, the relation of the several reproductive organs in the development of the flower; and third, the correlation of vegetative growth of the plant with the reproductive system.

(4) Hand pollination of flowers has reduced the number of unfruitful flowers from 66 percent to 20 percent of the total number of flowers produced, the percentage of reduction depending upon the comparative thoroughness of the pollination.

(5) Of various methods of pollination tried, the emasculation method has been more widely used than any other. It is recommended principally because of the ease in applying the pollen, prevention of duplication of pollination, and thoroughness of application at a time when the flower is most receptive.

(6) Regularity and thoroughness of pollination are conducive to high plant production, whereas inexperienced labor, haste, and irregularity in doing the work may not produce profitable net results.

(7) Hand pollination of blossoms increases the earliness of fruiting, beginning with a rapid enlargement of the ovary after pollination in comparison with comparatively slow development of many flowers which are self-pollinated. Fruit produced from hand-pollinated flowers has been harvested as early as twenty-one days before fruit from plants not artificially pollinated.

(8) Labor cost of pollination has been accounted for in relation to yields of pollinated and unpollinated plants. Statistics show that the cost of pollination during the season was approximately three cents a plant.

(9) Results indicate that it pays to hand pollinate to the extent where the increased returns sufficiently exceed in value the labor cost to leave a margin of profit.

ADDITIONAL INVESTIGATIONS

Reichard and White[1] in a series of tests of natural pollination compared with hand pollination report that the latter made a large increase in quantity and size of fruit. The spoon method of pollination was used. Some English varieties with short styles did nearly as well with natural pollination as with hand pollination. Other varieties have greatly benefited by hand pollination. Jarring made a very fair crop.

Zimmerly[2] briefly refers to facts already established, recommending the watch-glass method of hand pollination.

Radspinner[4] investigated the subject of blossom drop and yields of field tomatoes, relating mostly to the dropping of immature blossoms. Conclusions reached were that high temperature, low atmospheric humidity, and limited moisture supply induced formation of the abscission layer.

THE TOMATO FLOWER IN RELATION TO POLLINATION

In the following discussion concerning the economic effects of hand pollination, various terms regarding portions of the flower are used which might be confusing to some readers who have not studied the make-up of the blossoms, hence the relation of the different parts of the flower to pollination is here considered.

Tomato flowers are borne on clusters averaging from 5 to 12 blossoms to the cluster. In the variety Bonny Best, which was observed more than other varieties, the number of flowers to a cluster averaged 5 to 9. The flowers on a single cluster develop at different times in the age of the plant, so that there are blossoms in various stages of development at the same time. Fig. 1 shows a typical cluster of flowers in which each blossom is in a different stage of development.

Looking at a single blossom it will be noticed that the yellow petals above the green sepals are divided into lobes, all comprising the so-called corolla of the flower. The petals indicate by their appearance and development the maturity of the sexual organs of the flower. At first, when the blossom is in bud, the yellow petals are not in view, but later they open until they are well reflexed or fully expanded, in which condition the pollen is freely discharged. Later on, the petals close together, fade in color, and begin to shrivel and dry. After several days they will often dry quite hard and stiff, remaining persistent through the calyx for a short period before dropping.

The stage of development of the petals is a vital factor in the emasculation method of hand pollination described in this circular, inasmuch as the success of rapid emasculation and pollination of the

stigma depends upon the condition of the petals. These details are considered under the heading, Methods of Artificial Pollination.

The stamens, which are the parts of the flower acting as the male sexual organs, bear on the inner side small sacs, called anthers, from which the pollen grains are discharged. The erect essential organ of the flower protruding through the stamens as they come together at the tip is the pistil, functioning as the female sexual organ. Its enlarged

Fig. 1. Cluster showing blossoms in various stages of development. (a) Flower in extreme left has opened and later closed its petals, being now in condition for emasculation and pollination. (b) Flower in upper right with petals reflexed is one from which pollen can be obtained in pollinating. Some flowers as shown in middle left have already become barren.

outer end is the stigma, which has a sticky surface, and which receives the pollen grains as they are shaken from the anthers. At the base of the pistil is the ovary, containing ovules, which afterward become matured seeds when the stigma is properly fertilized by pollen grains.

METHODS OF ARTIFICIAL POLLINATION

There are several ways in which tomato flowers may be artificially pollinated, varying in time, labor, and effectiveness.

Shaking the plants. The quickest and simplest method consists in tapping or jarring the vines, clusters, or individual flowers of each plant. A padded stick or lead pencil may be used in this shaking. Because of the condition of the anthers for discharging pollen only those clusters of flowers having well reflexed or fully expanded petals or those having the petals but recently closed should be tapped. Time would only be wasted in stopping to shake other blossoms.

Spoon or slide method. Second, pollen may be collected on a spoon or glass slide from flowers with expanded corollas. As the operator passes from flower to flower the pollen receptacle is held up to the stigma of the pistil, protruding through the center of the flower, so that a slight tapping of the blossom is sufficient to bring the stigma in contact with the pollen.

There are disadvantages connected with this method which often preclude greatest efficiency for the time and labor employed. An operator may go through the motions of pollinating by the spoon or slide method without actually getting contact between the stigma and the pollen on the slide or spoon. Very often, in spite of the fact that the petals may be fully reflexed, the pistil will not have sufficiently developed in some flowers so that the stigma can be touched by the pollen receptacle. Third, there is no means of preventing duplication of pollination, since it is impossible to tell in pollinating a large number of blossoms whether a certain flower has been previously pollinated. Fourth, flowers that have closed their petals following the full expansion cannot have their stigmatic surface pollinated without emasculation.

It is true, however, that this spoon or slide method of pollination may produce larger net yields than where no pollination is practiced. If the work is properly done or the variety has a tendency to push the stigmatic surface through the center of the flower, which is a characteristic of some varieties, but not of others, the method is rapid and effective in preventing a large number of blossoms from becoming barren.

Emasculation method. Emasculation is the act of removing the male portion or anthers of the flower. In the case of the tomato, this simply means pulling off the petals or the blossom itself, for the anthers or male portions of the flower are attached in this case to the petals. When the flower is removed, therefore, nothing is left but the female organ, the pistil, at the end of which is the stigmatic surface, which is the vital point for contact with the pollen.

There is a certain condition of the tomato flower in which emasculation should be done; namely, when the flower has begun to close its petals, and is beginning to show a faded or pale color. This condition is shown plainly in Fig. 1.

If emasculation is done earlier than the above conditions, the flower may pull off with difficulty; also the stigmatic surface is not in its best receptive condition for contact with pollen. Again, care should be taken

that the flowers are not allowed to become too far developed before being emasculated. If left for several days after the petals have closed they will become dry and difficult to remove. There is danger also of breaking the pistil from the ovaries if the flower is handled in this condition. The stigma, moreover, is past the receptive stage for fertilization.

The best way is to emasculate only those flowers in the ideal condition (which can soon be ascertained by the operator after a little observation and practice), and then to pollinate their stigmas.

Pollen collected on the finger may be applied to stigmas of flowers which have been previously emasculated by the operator. This method has proved to be quick in performance and effective in results. Details of this method are as follows:

Pollen is obtained from any flowers having their petals well reflexed or turned back, in which stage of development the anthers freely discharge pollen. The pollen is collected on the first, second, and if desired the third fingers of the left hand in such quantity that the first joints of the fingers are well coated with pollen. Constant practice in collecting will soon enable the operator to observe at a glance which flowers are likely to discharge pollen. By carrying a quantity of pollen a large number of flowers can be pollinated.

The next step is to select the flowers to be pollinated. On each cluster there are certain blossoms which have opened fully and later closed their petals. These, as has been mentioned in the previous paragraph, are the ones selected for pollination. The blossoms can be quickly emasculated (that is, the petals and stamens removed) with the thumb, second, and third or fourth finger of the left hand, the right hand holding the flower back of it in order to steady the operation, as shown in Fig. 2. The flower being emasculated, pollen can be quickly touched to the end of the pistil.

There are several advantages in this method of pollination: first, the stigma is in a receptive condition at the time the petals first close after having been previously reflexed, insuring fertilization when pollen is applied from the finger after emasculation; second, the contact of pollen with stigma is sure, even, and ample, because the pistil can be seen and easily worked on following the removal of the flower; third, there is no possibility of a flower being pollinated more than once, because all flowers found emasculated have been operated on and will be omitted by the operator in the next day's work. This makes sure a saving in time and labor, which is impossible by other methods. It also prevents any flower being passed by unnoticed, since the flowers with closed petals are easily distinguished from the others on the cluster.

On the recommendation of the Oregon Experiment Station this method of pollination has been tried by several growers, who have reported good results under thorough tests. Because of its general success and the advantages specified, it is the method now most favored by this Station.

Fig. 2. Petals of this flower are being removed for pollination of stigma. Note pollen on first joints of first and second fingers; thumb and third finger are pulling off the corolla, while the thumb and first finger on right hand steady the operation, holding the flower back of the sepals.

Fig. 3. Contact of pollen from finger to stigma. Abundance of pollen is carried on the finger so that many flowers may be pollinated before further collection of pollen becomes necessary.

IMPORTANT POLLINATION ITEMS IN BRIEF

1. Pollination should be done every second or third day.

2. The lowest clusters are the most valuable and should receive close attention.

3. Many blossoms from which pollen is obtained to use in the work are fertilized through shaking to obtain the pollen.

4. Blossoms can be emasculated quickly by a single movement and pollinated at the rate of one every few seconds.

5. To do so, an abundance of pollen must be carried on the finger tips and the operator must move rapidly in picking off the flowers and touching the stigma.

6. No flower is missed nor duplicated by the emasculation system.

7. Short styles which do not protrude through the corolla to be touched by pollen on the slide or watch-glass do not escape the finger of the emasculator.

PRECAUTIONS NECESSARY IN POLLINATION OF BLOSSOMS

1. Flowers should not be allowed to become too far developed before being emasculated.

2. In emasculation, the corolla should be pulled off straight from the calyx; that is, at no decided angle, otherwise the pistil is likely to be broken off.

3. Practice in emasculating several flowers will quickly show the operator the points of the work in which particular care is necessary. Rapidity and efficiency of operation will result after many blossoms have been removed and stigmas pollinated by the method described.

DETAILS OF CROP PRODUCTION

(1) The variety used exclusively in the experiments was Bonny Best, a special greenhouse strain.

(2) The date of seeding was January 1, the first transplanting February 1, the plants were potted February 26 to March 1, and the plants set in beds March 10 to 15.

(3) Average distances of setting plants, 16 by 32 inches.

(4) All plants were trained to a single stem and grown to seven clusters, then topped.

(5) Ripe fruit first harvested about May 26.

(6) Plants removed August 15 to 20.

(7) Soil consisted of sandy loam with rotted manure applied before spinach crop, which preceded the tomato plants.

(8) Manure supplemented with top dressing of complete commercial fertilizer applied before plant setting or soon afterward. Fertilizer consisted of nitrate of soda, superphosphate, and sulfate of potash in the proportion of 150, 300, 100 pounds respectively, an acre.

(9) At the time of plant removal, the diameter of the stems of plants averaged three-quarters of an inch, showing vegetative growth in relation to fruitfulness.

(10) Preceding crop spinach.

TABLE I. STATEMENT SHOWING HARVESTING OF CROPS, TOTAL YIELDS, AND NUMBER OF FRUITS PRODUCED, HAND POLLINATED

Plot number	Number plants observed	Yield *per plant* to June 26		June 26 to July 26		July 26 to end	Total yield per plant		Number fruits harvested per plant	Average weight per fruit
		lbs.	*oz.*	*lbs.*	*oz.*	*oz.*	*lbs.*	*oz.*		*oz.*
1. a	17	3	12	7	6	13	12	1	31	6.2
b	17	3	2	7	3	14	10	10	29	5.8
c	17	3	2	7	3	14	11	3	30	5.9
2. a	17	3	7	7	13	15	12	3	32	6.0
b	17	3	6	8	0	11	12	1	31	6.1
c	17	3	0	7	12	13	11	9	30	6.1
3. a	17	2	5	7	2	8	10	15	25	7.0
b	17	2	7	7	6	7	10	4	27	6.0
c	17	2	2	7	12	11	10	9	28	6.0
4. a	17	4	1	7	5	7	12	13	30	6.5
b	17	3	13	8	1	9	12	7	32	6.2
c	17	3	8	7	11	5	11	8	30	6.1
Average, Plot 1	51	3	5	7	4	14	11	7	30	5.9
Average, Plot 2	51	3	4	7	13	13	11	14	31	6.1
Average, Plot 3	51	2	4	7	6	8	10	2	26	6.3
Average, Plot 4	51	3	12	7	11	7	11	14	31	6.2
Mean, all plots	204*	3	2	7	11	10	11	5	29	6.2

* Total number of plants observed.

Analysis

1. Each plot within itself shows a uniformity of yield, as is also indicated by the average of the plot and the mean of all the plots.

2. The amounts of fruit harvested during each section of the season vary but slightly within the plots or between them.

3. The number of fruits harvested per plot are quite similar. The average weight per fruit indicated a general uniformity throughout.

4. The general uniformity of the figures show that the plants under observation and test behaved normally and similarly under treatment of pollination and under similar cultural practices.

HOW CAN THE YIELD BE INCREASED?

Observations indicate that yields of tomatoes grown in commercial greenhouses vary to a considerable extent. Reports to this Station from various states as well as Canada are to the effect that yields of 5, 6, and 7 pounds per plant have been generally obtained.

In 1912 the first 300-egg hen appeared at the Oregon Experiment Station; since that time many hens have made a like record. Progress along such lines is possible with tomatoes.

In order to increase the yield of tomato plants there must be greater fruitfulness of the plant. Blossoms which would drop must be made to bear fruit. Some form of pollination must be practiced to bring this about, which if properly and regularly carried out, will produce

an economic gain by materially increasing the yield at an expense incurred which is extremely small in view of the actual increased returns.

One grower with whom the Station has cooperated in the work writes as follows: "In a general way the benefit of pollination especially early in the season is very great, possibly increasing the yield thirty to forty percent. You, of course, know that pollination of tomatoes in our houses and in other commercial plants of the state was due entirely to work done at the College in an experimental way and afterwards tried out on a commercial scale to prove its worth. A heavier set of fruit resulting in earlier and increased yields always results where this method is followed conscientiously."

WHAT IS THE RELATION BETWEEN **HIGH** YIELDING TOMATO PLANTS AND THE NUMBER OF FRUITS PRODUCED BY EACH PLANT?

TABLE II. STATEMENT SHOWING RELATION OF NUMBER OF FRUITS BORNE TO TOTAL YIELD

Plant number		Number of fruits harvested	Number of fruits compared average of all	Total yield		Compared average		Weight per fruit	Number of fruits produced compared with average of low yielding plants
				lbs.	*oz.*	*lbs.*	*oz.*	*oz.*	
1a	1	38	+ 9	14	2	+2	10	6.0	+21
1a	4	40	+11	17	2	+5	10	6.8	+23
1a	6	37	+ 8	14	3	+2	11	6.0	+20
1a	14	36	+ 7	13	3	+1	11	5.8	+19
1a	15	40	+11	14	11	+3	3	5.8	+23
1b	5	43	+14	13	15	+2	7	5.1	+26
1b	9	44	+15	16	12	+4	4	6.0	+27
1b	13	42	+13	16	3	+4	11	6.1	+25
1c	13	37	+ 8	15	13	+4	5	6.0	+20
1c	14	45	+16	15	13	+4	5	5.6	+28
2a	3	35	+ 6	14	0	+2	8	6.4	+18
2a	7	40	+11	14	14	+3	6	5.9	+23
2a	11	38	+ 9	15	3	+3	11	6.4	+21
2a	17	45	+16	14	5	+2	13	5.0	+28
2b	16	48	+ 9	16	11	+4	3	5.5	+31
2c	9	32	+ 3	14	0	+2	8	7.0	+15
2c	10	39	+10	16	3	+4	11	6.6	+22
2c	11	34	+ 5	14	9	+3	1	6.8	+17
2c	14	35	+ 6	14	1	+2	9	6.4	+18
Mean		39	+ 9	14	12	+3	4	6.0	+22

Analysis

1. The weight of individual fruits is the same as that of the low yielding plants, 6 ounces.

2. The high yield is directly attributable to the larger number of fruits produced on the plant. Pollination was responsible for the heavy setting.

3. An average of 30 fruits and upwards weighing 6 ounces apiece is capable of giving a desirable yield of 11 pounds plus.

4. Compare the number of fruits with those in the low yielding plant table.

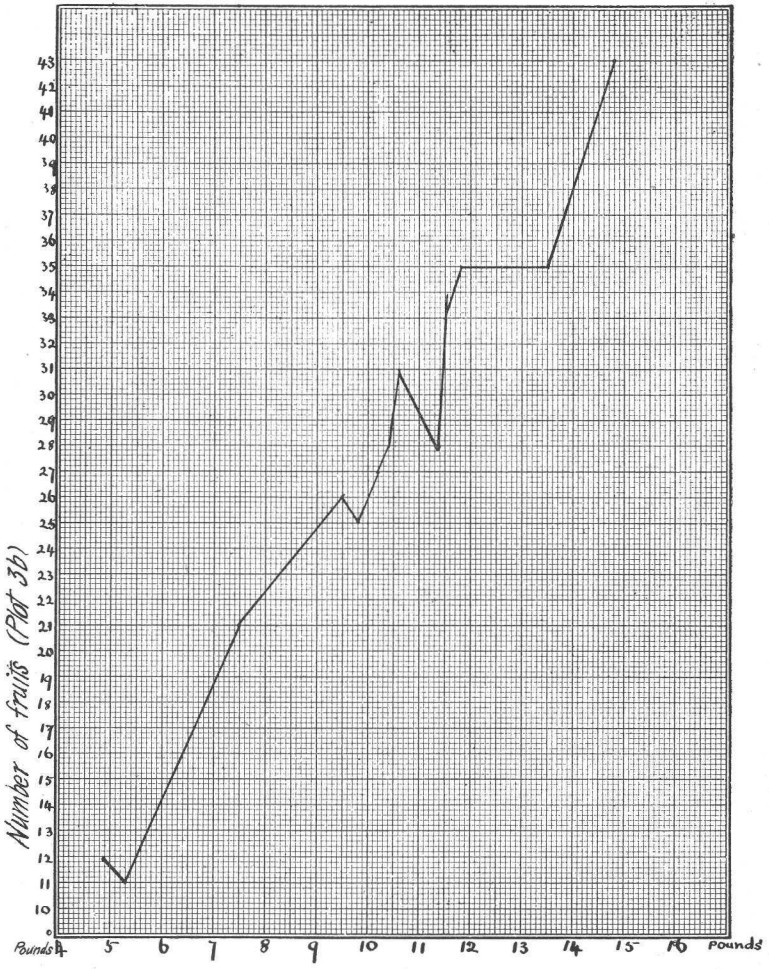

Fig. 4. Chart showing relation of number of fruits produced to actual yield in pounds. The curve indicates generally a uniform increase in yield according to the producing power of the plant.

WHAT IS THE RELATION BETWEEN **LOW** YIELDING TOMATO PLANTS AND THE NUMBER OF FRUITS PRODUCED BY EACH PLANT?

TABLE III. STATEMENT SHOWING RELATION OF NUMBER OF FRUITS BORNE TO TOTAL YIELD

Plant number	Number of fruits harvested	Number of fruits compared average all plants	Total yield	Compared with average of all plants	Weight per fruit	Percent of loss compared with average
			lbs. oz.	*lbs. oz.*	*oz.*	
1a 17	22	— 7	6 14	—4 7	5.0	67
1b 14	21	— 8	8 3	—3 2	6.2	40
3a 4	19	—10	6 8	—4 13	5.4	86
3a 9	16	—13	7 4	—4 1	7.2	58
3a 10	18	—11	5 11	—5 8	5.0	100
3b 11	11	—18	5 5	—6 0	7.7	116
3b 12	12	—17	5 15	—6 6	6.5	152
3b 14	21	— 8	7 7	—3 14	5.6	54
3c 11	13	—16	5 11	—5 10	7.0	100
4c 12	18	—11	7 7	—3 13	6.6	54
4c 13	15	—14	6 5	—5 0	6.3	82
4c 16	20	— 9	7 9	—3 12	6.0	52
Mean	17	—12	6 9	—4 12	6.1	80

Analysis

1. The size of the fruit of the above plants was equal to those of the high yielding plants.

2. The low yield is directly traceable to the smaller number of fruits produced per plant. Lack of pollination was responsible for this condition.

3. An average of 17 fruits weighing 6 ounces each is insufficient to constitute a desirable yield.

4. Compare the number of fruits with those in the high yielding table, the fruits in each case individually weighing alike.

WHAT INFLUENCE DOES POLLINATION HAVE UPON EARLIER RIPENING OF FRUIT AND PERCENTAGE OF CROP HARVESTED DURING EARLY PERIODS OF PICKING SEASON?

Analysis

1. Each plant named in Table IV was regularly pollinated.

2. Particular attention was given to the setting of fruits on the first three clusters, which represent the bulk of the crop harvested during the early periods.

3. The first period was from May 26 to June 26; second period, June 26 to July 26; third period, July 26 to August 10-15.

4. Comparison of figures shows that 160 percent more fruit was harvested during the first period in Table IV than in Table V.

TABLE IV. STATEMENT SHOWING RELATIVELY HIGH AMOUNT OF FRUIT PICKED DURING FORE PART OF SEASON. ALL PLANTS HAND POLLINATED

Plant number	Yield first period	Percent of total	Yield second period	Percent of total	Yield period third	Percent of total	Total yield
	lbs. oz.	%	*lbs. oz.*	%	*lbs. oz.*	%	*lbs. oz.*
1a 1	6 5	44	6 1	42	1 12	12	14 2
1a 3	5 12	33	10 5	60	1 1	6	17 2
1a 5	5 5	45	6 7	54	.. ....	..	11 12
1a 6	6 11	47	7 3	50	.. 5	2	14 3
1a 9	6 7	52	5 7	43	.. 8	4	12 6
1b 9	4 15	30	11 9	69	.. 4	..	16 12
1c 5	5 11	40	6 4	49	1 6	9	13 15
1c 6	5 10	46	6 0	50	.. 6	3	12 0
2a 7	5 2	34	8 4	55	1 8	10	14 14
2a 10	5 10	41	7 0	52	.. 13	6	13 7
2a 11	5 9	36	8 0	53	1 10	10	15 3
2b 6	5 2	38	7 5	54	.. 14	6	13 5
2b 8	5 11	42	5 6	40	2 5	17	13 6
2c 9	5 0	39	7 10	54	1 6	6	14 0
2c 10	4 9	28	10 3	62	.. ..	9	16 3
2c 14	4 4	30	9 13	70	.. 0	..	14 1
Mean	5 7	39	7 10	53	.. 12	7	14 2

TABLE V. STATEMENT SHOWING RELATIVELY LOW AMOUNT OF FRUIT PICKED DURING FORE PART OF SEASON, NATURAL POLLINATION ONLY DURING FIRST PERIOD

Plant number	Yield first period	Percent of total	Yield second period	Percent of total	Yield third period	Percent of total	Total yield
	lbs. oz.	%	*lbs. oz.*	%	*lbs. oz.*	%	*lbs. oz.*
1a 12	1 13	20	6 5	71	12	8	8 14
1a 17	2 11	39	3 11	53	8	7	6 14
1b 3	2 14	26	5 3	46	3 0	7	11 1
1b 10	1 6	13	6 12	66	2 0	19	10 2
1b 14	1 14	22	5 8	67	.. 13	9	8 3
1b 15	2 6	25	5 12	61	1 3	12	9 5
1c 10	1 1	12	5 13	70	1 8	17	8 6
2a 13	6	4	7 4	85	.. 13	10	8 7
2a 16	2 9	21	7 14	64	1 11	13	12 2
2c 2	2 5	24	5 1	53	2 1	22	9 7
2c 3	2 5	24	5 8	58	1 9	17	9 6
2c 16	12	7	9 1	85	13	7	10 10
3a 4	14	13	4 13	74	13	12	6 8
3a 10	1 0	17	4 11	82	0	0	5 11
3a 14	1 7	16	6 8	72	1 1	11	9 0
3b 11	0	0	5 5	100	—0	0	5 5
3b 12	0	0	4 5	87	10	12	4 15
3b 14	8	6	6 0	80	15	13	7 7
3c 11	0	0	5 4	92	7	7	5 11
3c 16	1 2	10	5 7	56	3 1	33	9 10
3c 17	1 5	15	6 12	77	10	7	8 11
Mean	1 3	15	5 13	72	2 0	12	9 0

Analysis

1. The yields were uniformly low during the first period when highest market prices prevailed.

2. The average total yield of plants in Table V was 63 percent of that of plants in Table IV; the yield during the last period was almost 100 percent greater than in Table IV.

WHAT PERCENTAGE OF TOMATO BLOSSOMS, HAND POLLINATED, ACTUALLY BEAR FRUIT UNDER NORMAL COMMERCIAL CONDITIONS?

TABLE VI. STATEMENT SHOWING FRUITFULNESS OF BLOSSOMS OF HIGH YIELDING PLANTS

Plot number	Cluster number	Blossoms fruitful	Blossoms barren	Total blossoms per cluster	Percentage fruitful	Blossoms barren	Blossoms fruitful per cluster
2a 7, 10, 11	1	301	66	6.7	84	14	5.5
2b 6, 8	2	317	115	8.2	77	22	6.3
4a, b, c	3	286	144	9.3	70	30	6.5
	4	356	154	10.1	72	27	7.3
	5	317	152	8.9	70	29	6.2
	6	349	148	11.6	66	33	7.4
Mean	6 clusters	320	129	9.1	74	26	6.5

Analysis

1. The number of blossoms on a cluster normally increases as the plant lengthens.

2. About three quarters of the total number of flowers of the plants produced marketable fruit.

3. If a plant bears an average of 9.1 flowers per cluster and an average fruiting of 74 percent there should be 6.5 fruits produced per cluster.

4. Detection of the fruitfulness of blossom clusters can be made of any crop after harvesting season by observing, respectively, the stem scars where fruit has or has not been picked.

WHAT IS THE RELATION BETWEEN FRUITFUL AND UNFRUITFUL BLOSSOMS ON AN INDIVIDUAL CLUSTER?

TABLE VII. STATEMENT SHOWING FRUITFULNESS OF CLUSTERS, ALL EXPERIMENTAL PLANTS, HAND POLLINATED.
Average of 1,100 clusters—9,473 blossoms.

Cluster number	Blossoms fruitful	Blossoms barren	Total blossoms	Percentage blossoms fruitful	Percentage blossoms barren
1	5.1	1.4	6.5	78	21
2	5.1	2.0	7.1	71	28
3	5.1	2.9	8.0	63	36
4	6.0	2.9	8.9	67	32
5	6.1	3.2	9.3	65	34
6	5.6	4.1	9.7	57	42
7	4.9	4.2	9.1	54	45
Mean	5.4	3.0	8.4	65	34

Analysis

1. The above figures correlate very closely with those of previous observations mentioned in Oregon Station Bulletin 158.

2. The total number of blossoms that are fruitful is slightly higher than the actual number of fruits harvested from the average plant. This is accounted for by the fact that blossoms, particularly toward the latter part of the season, may produce fruit which is not actually salable and therefore does not show on the harvesting records.

3. Table VII shows that a larger percentage of blossoms set fruit in the lower clusters of the experimental plants than in the upper clusters. The former received more careful pollination and produced the highest priced fruit.

POLLINATION TERMS DEFINED

1. *Calyx,* made up of sepals which are green and enclose the other flower parts.

2. *Corolla,* made up of petals, the colored portions of the flower.

3. *Stamens,* attached to the corolla in the tomato, the male sexual organ.

4. *Anthers,* longitudinal slits on the inner side of the stamens, bearing pollen grains.

5. *Pistil,* female sexual organ, having at the base the ovary, which is the embryo tomato, and the style, a slender stalk leading from the ovary.

6. *Stigma,* end of style, receptive to pollen.

7. *Emasculation,* the act of removing the male organs from the flower.

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