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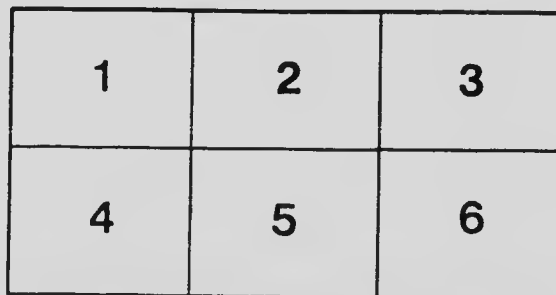
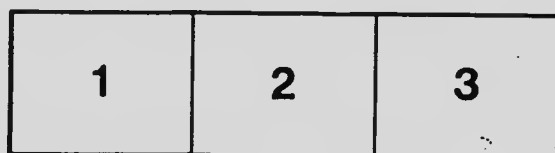
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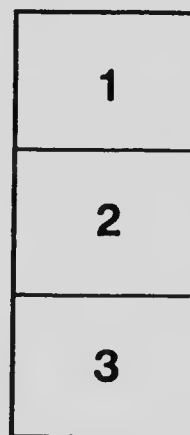
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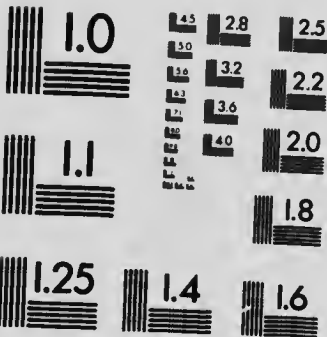
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TOBACCO DIVISION



EXPERIMENTAL WORK
1909

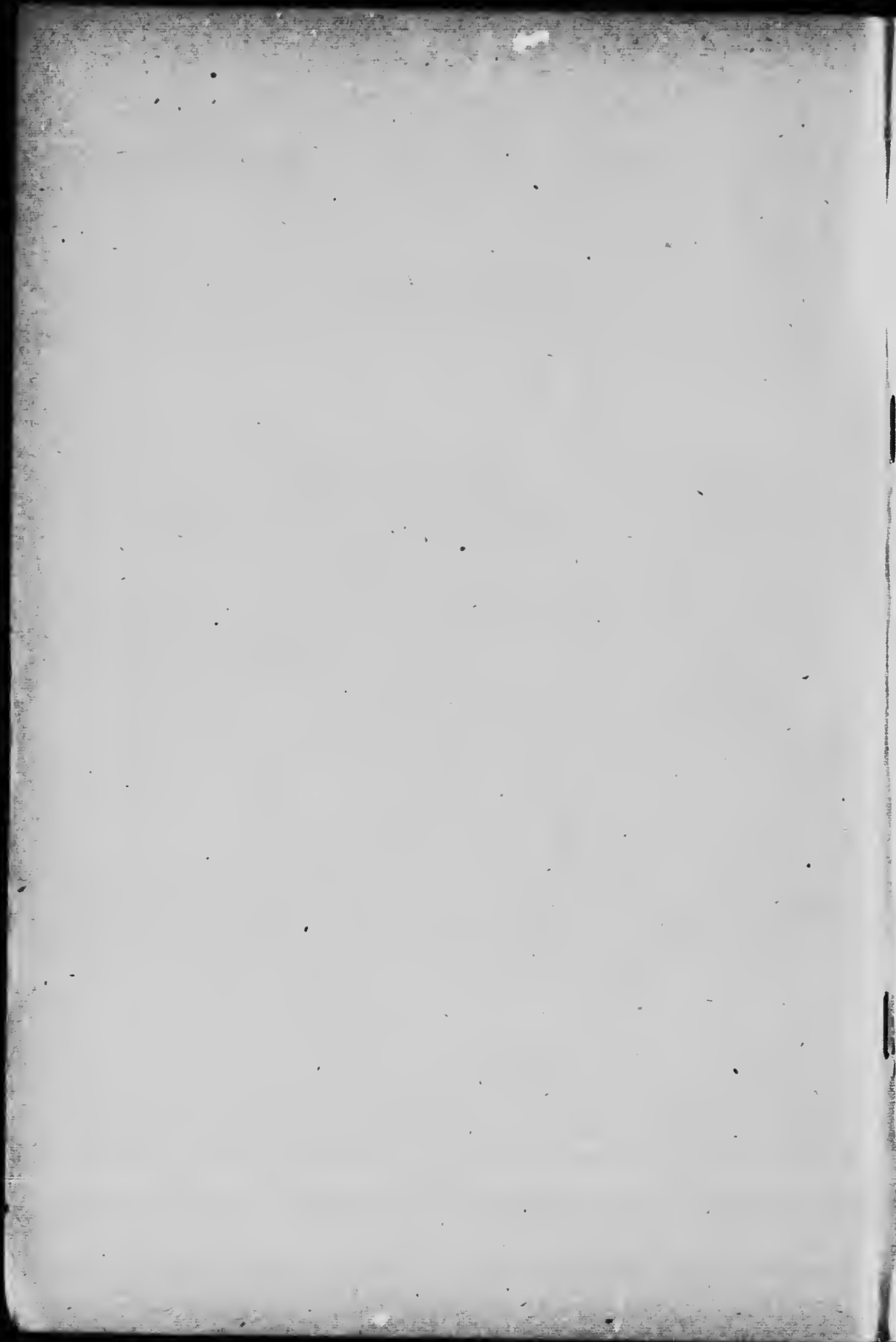
BY
F. CHARLAN

Tobacco Bulletin No. A 8

Published by order of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa, Ont.

DECEMBER, 1909.

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OTTAWA, CANADA

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EXPERIMENTAL WORK
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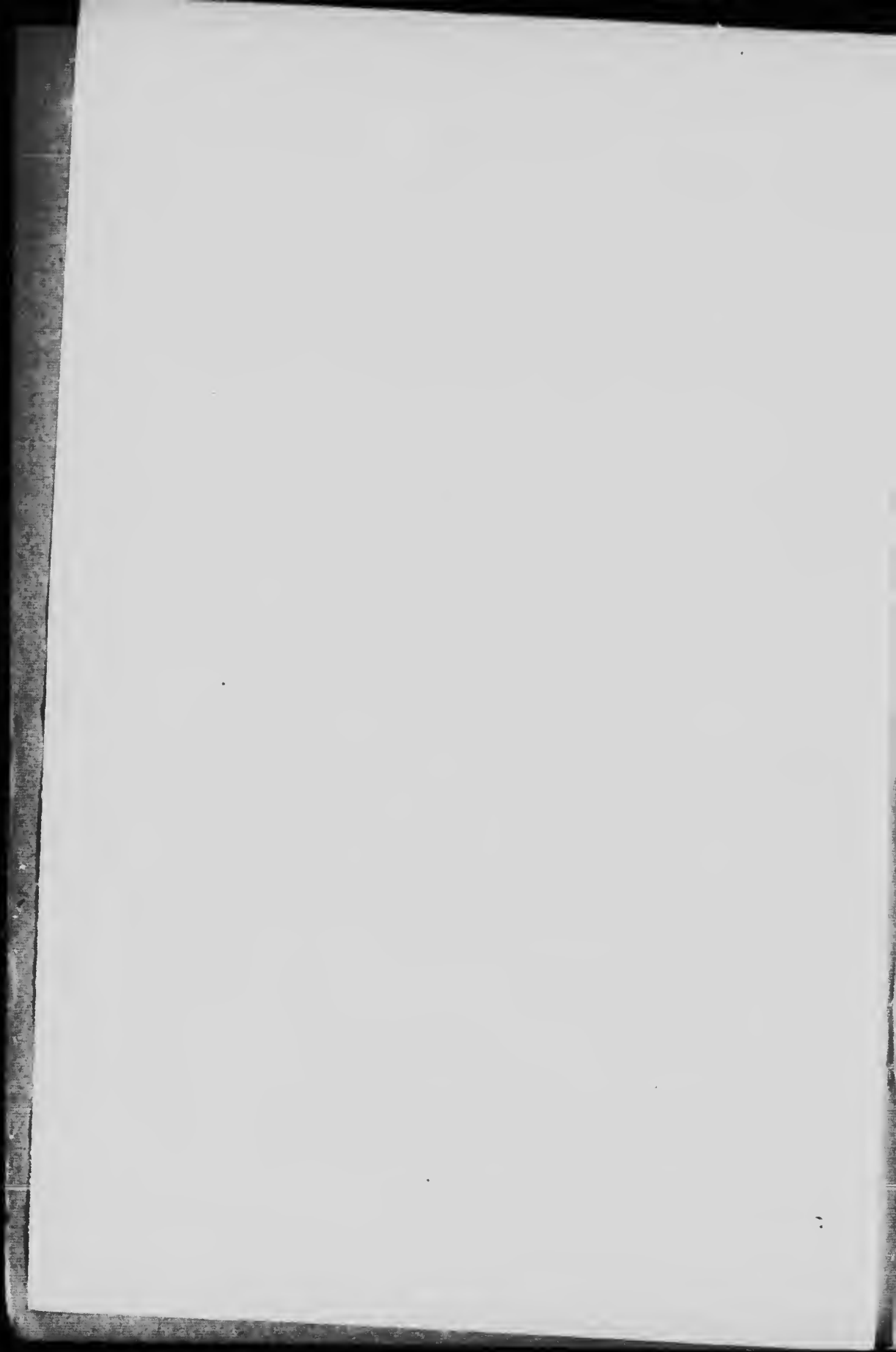
BY
F. CHARLAN

Tobacco Bulletin No. A-8

Published by order of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa, Ont.

DECEMBER, 1909.

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Ottawa, December 5, 1909.

To the Honourable Minister of Agriculture,
Ottawa.

Sir:—I have the honour to transmit herewith Bulletin No. A—8, of the series of the Tobacco Division, entitled 'Experimental work, 1909.'

This Bulletin contains the final results of tests made at the Central Experimental Farm, Ottawa, during the years 1908 and 1909, and some suggestions as to the use of tobacco seed, which, I hope, may prove useful to a number of Canadian growers. I recommend that it be printed for distribution.

I have the honour to be,

Sir,

Your obedient servant,

F. CHARLAN,

Chief of the Tobacco Division.

CONTENTS.

- PART I.** Experiments in the growing of seed plants.
- PART II.** Sterilization of soils—Seed tests—Thickness of seeding.
- PART III.** The value to Canadian farmers of home grown tobacco seed.

NOTE.

As this Bulletin is going to press, we read in the 'Bolletino tecnico della coltivazione dei tabacchi, R. Istituto Experimentale, di Scafati Italia,' a report of the work of Mr. Vasile Archirescu on the fertilization of flowers and the germination of the seeds of Oriental tobacco, in which, in order to avoid hybridation, the panicles are covered with paper bags before fertilization.

In this work, inspired by our first test, the author has obtained results slightly different from ours and which he ascribes, to a certain extent, to the influence of the meteorological conditions prevailing at the time of fertilization, as also when the capsules were forming and reaching maturity.

The conditions of the experiment were rather different, the varieties having but very remote connections with our tobaccos, and the number of capsules preserved in Mr. Archirescu's test being very small, while it was normal (75 to 80) in our own test.

With regard to the percentage of seeds germinated, our second test, with averages varying from 77 to 94.16 per cent, gave results that may be compared to those obtained by the Italian experimenter.

With him, we have observed, especially in 1909, when the last part of summer was not very hot, that by keeping bags over the panicles the maturity of the capsules is considerably delayed. It is not only on account of this drawback that we advocate mixed culture, but it is another argument in its favour.

PART I.

EXPERIMENTS IN THE GROWING OF SEED PLANTS.

(By F. Charlan.)

A series of experiments, reported in Bulletin No. A-6 of the Tobacco Branch, was carried on in 1908, with a view to determine the most favourable condition for the production of tobacco seed, the most suitable time for harvesting ripe seeds and the care seed plants should receive.

These experiments included a germinating test, made by the Seed Branch, at Ottawa, which test was to be repeated when the seeds would be perfectly matured.

This new test of the older seeds was made in April, 1909. The results are given in the following table, with the results of the first test, made in December, 1908, for comparison.

Number.	Description of Seeds.	GERMINATOR.				Artificial soil.	
		Test. Dec. 1, '08.		Test. Apr. 22, '09.		p.c.	p.c.
		p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
661.	X-A	39	53	93	95	72	*
662.	X-B	22	37	85	92	66	*
663.	X-C	13	24	69	81	64	*
664.	XX-A-R	70	83	96	98	84	84
665.	XX-A-1R	78	89	95	97	73	78
666.	XX-B-R	21	31	91	97	83	88
667.	XX-B-1R	60	66	84	90	79	79
668.	XX-C-1R	22	35	92	95	81	87
669.	XX-C-R	2	4	79	88	85	95
670.	XXX-A-R	61	78	89	91	84	75
671.	XXX-A-1R	46	76	88	96	84	91
672.	XXX-B-R	56	68	84	89	74	74
673.	XXX-B-1R	18	33	94	98	83	86
674.	XXX-C-R	2	13	77	88	70	60
675.	XXX-C-1R	60	79	90	93	80	76
676.	Cuba—capsule by capsule	35	58	78	87	61	72
677.	Cuba—by cluster	73	83	87	91	60	52
683.	Comstock No. 1, August 20	66	74	88	94	65	*
684.	" " " 24	83	90	91	94	83	*
685.	" " " 28	82	92	93	96	89	*
686.	" " September 1	67	76	78	84	71	66
687.	" " " 5	36	53	93	98	73	85
688.	" " " 9	7	16	56	60	45	44
689.	" No. 2, " 1	60	75	93	96	69	76
690.	" " " 5	15	26	54	61	25	34
691.	" " " 9	7	20	19	34	24	21

* The test plot having been attacked by mould, no data were recorded.

EXPLANATION OF SIGNS AND LETTERS:

- | | |
|--|------------------------------|
| X—Entirely under bage. | B—All leaves removed. |
| XX—In the open air. | C—Lower leaves only removed. |
| XXX—Fertilized under bage,
ripened in the open air. | R—Ripe. |
| A—Top leaves removed. | 1R—Half ripe. |

The first test, made in December, was conducted in darkness, and the second, made in April, under diffused light, in another germinator.

The difference in favour of the second test shows that light has a considerable influence on germination and that, in practical work, a higher proportion of seedlings may be expected from dry seeds germinated before sowing. The great objection to artificial germination is that it must be carried on in the dark, and this, as shown by this experiment, has a weakening effect upon the germ. Artificial germination, therefore, should be practised only in extreme cases, when it is absolutely necessary to save time.

I. RESULTS OBTAINED FROM HEADS OF FLOWERS KEPT UNDER BAGS.

When the panicles are covered with paper bags, with the object of preventing cross-fertilization, should the bags be left till the seeds are perfectly matured, or should they be removed earlier? On the other hand, is the vitality of seeds greater when they are grown in the open air than when they are grown under bags?

The results obtained are compared in the following table:—

TABLE II.

Number.	GERMINATOR.		ARTIFICIAL SOIL.
	4 days.	14 days.	21 days.
X. CAPSULES FERTILIZED AND RIPENED UNDER BAGS.			
	p. c.	p. c.	p. c.
661	93	95	•
662	85	92	•
663	69	81	•
	247 = 82.33	268 = 89.33	
	3	3	
XX. CAPSULES FERTILIZED AND RIPENED IN THE OPEN AIR.			
	96	98	84
664	95	97	78
665	91	97	88
666	84	90	79
667	92	96	87
668	79	89	95
669	537 = 89.5	565 = 94.16	511 = 85.16
	6	6	6
XXX. CAPSULES FERTILIZED UNDER BAGS AND RIPENED IN THE OPEN AIR.			
	89	91	75
670	83	96	91
671	84	89	74
672	94	98	86
673	77	88	60
674	90	93	76
675	522 = 87.00	555 = 92.5	462 = 77.00
	6	6	6

The only seeds that are of inferior vitality are those that were grown entirely under bags.

The results of mixed and open air culture are strikingly similar; while our first test favoured mixed culture, the second, judged by the percentage of germination, was slightly in favour of open air culture.

However, mixed culture is recommended as the best method. The yield of seeds is sufficiently heavy, the percentage of germination good, and, with sufficient care, there is no risk of cross fertilization.

Moreover, by removing the bags as soon as a sufficient number of capsules are formed, mould is avoided, whereas if the plants were left covered until harvest time in continued damp weather, it might develop. This injury is most to be feared near ripening time.

II. RESULTS FROM LEAVING ALL THE LEAVES ON THE PLANT, OR REMOVING ALL THE LEAVES OR A PORTION OF THEM.

A summary of the results is presented in Table III.

TABLE III.

A TOP LEAVES REMOVED.				B ALL LEAVES REMOVED.				C LOWER LEAVES ONLY REMOVED.			
Germinator.		Artificial Soil.		Germinator.		Artificial Soil.		Germinator.		Artificial Soil.	
6 days.	14 days.	21 days.		6 days.	14 days.	21 days.		6 days.	14 days.	21 days.	
p. c.	p. c.	p. c.		p. c.	p. c.	p. c.		p. c.	p. c.	p. c.	
661	93	95	662	85	92	663	69	81
664	96	98	84	666	91	97	88	668	92	95	87
665	95	97	88	667	84	90	79	669	79	88	95
670	89	91	75	672	84	89	74	674	77	88	60
671	88	96	91	673	94	98	86	675	90	93	76
461		477		338		327		407		318	
5=92.2		5=95.4		4=84.50		5=87.6		5=93.2		4=81.75	
								5=81.4		5=89.00	
										4=79.5	

As in the preliminary test, the best seeds came from plants from which the top leaves only had been removed. The variations are not so marked as in the first test. However, they are far from being insignificant, and it is well to keep in mind the lesson to be derived from these experiments if one is really anxious to produce good seed and maintain the vigour and purity of the particular variety grown.

The reader is therefore referred to the conclusions contained in the first part of Bulletin No. A-6, which apply equally well to this test.

III.—INFLUENCE OF SEASON AND TEMPERATURE AT RIPENING.

TABLE IV.

Parent Plants.	Number.	Date of Harvesting.	Germinator.		Artificial Soil.
			6 days.	14 days.	21 days.
I	683	August 20	p.c.	p.c.	p.c.
	684	" 24	83	94	•
	685	" 28	91	94	•
	686	September 1	93	94	•
	687	" 5	78	84	•
	688	" 9	93	98	66
II	689	September 1	56	60	85
	690	" 5	93	96	44
	691	" 9	54	61	76
		" 9	19	34	54
					21

A comparison between these results and those obtained in the first test, (see Bulletin No. A-6), shows that the optimum period—the most favourable period for harvesting—is considerably lengthened. While the seed harvested on the 20th of August does not give the best results, yet its percentage of germination is sufficient, and the seed harvested on the 1st of September may also be considered as being of first quality. The seed harvested on the 5th, at least for one of the plants included in this test, gave a comparatively light yield and should be discarded.

The differences observed in these two tests support, if need be, the theory that tobacco seeds do not attain perfect formation until long after harvest. For this reason growers are advised not to use fresh seed, but to sow seed two or three years old, which will germinate more regularly and give a more even stand.

However, we insist particularly on the necessity of rejecting all late capsules, particularly in certain parts of Canada where they are found in such proportion as to depreciate the value of the seed and seriously compromise future crops.

IV. WHEN SHOULD THE CAPSULES BE GATHERED TO MAKE SURE OF SECURING RIPE SEEDS?

TABLE V.

Number.	GERMINATOR.		ARTIFICIAL SOIL.
	6 days.	14 days.	21 days.
A.—RIPE CAPSULES.			
	p.c.	p.c.	p.c.
664	96	98	84
666	91	97	88
669	79	88	95
670	89	91	75
672	84	89	74
674	77	88	60
	<u>516=86</u>	<u>551=91.63</u>	<u>476=79.23</u>
	6	6	6
	88.91		
B.—HALF-RIPE CAPSULES.			
665	95	97	78
667	84	90	79
668	92	95	87
671	88	96	91
673	94	98	86
675	90	93	76
	<u>543=90.5</u>	<u>569=94.63</u>	<u>497=82.83</u>
	6	6	6
	92.66		

As in the preliminary test, the difference is in favour of the seed gathered when the capsules have become brown, although, very often, what is left of the calyx is still green. The seed is then sufficiently ripe to complete its formation. This method has this advantage that the harvest can be made a little sooner and the capsules can be saved from the early frosts, seldom very dangerous, but always injurious.

IV. GATHERING CAPSULE BY CAPSULE, OR IN CLUSTERS.

TABLE VI.

Number.	Designation of Seeds.	GERMINATOR.				Artificial Soil.	
		Test: Dec. 1, '08.		Test: Apr. 22, '09.		p. c.	p. c.
		p. c.	p. c.	p. c.	p. c.		
676.....	Cuba—Capsule by capsule.....	35	58	78	87	71	72
677.....	Cuba—In clusters.....	73	83	87	91	60	52

The results of the germinator test are far from conclusive. They vary in one direction or another.

Under these conditions, when a small quantity of seed is grown, it will be better to harvest the seeds capsule by capsule, as, by this method, the grower is assured of obtaining only well formed and perfectly ripe seeds. When seeds are grown on a large scale, they may be gathered in clusters, care being taken, however, to clean the parent plants before harvesting, so as to remove as many as possible of the misshapen or unripe capsules. These are easily discovered on the plant before harvesting; but it is difficult to recognize them after some time, when the ripe and unripe capsules are sufficiently dry for shelling and have assumed a nearly uniform brown colour.

CONCLUSIONS.

The final test of artificial germination, further borne out by the results obtained on the beds (Part II of this Bulletin), fully corroborates the conclusions of our preliminary test. It will be sufficient therefore to repeat the recommendations given in Bulletin No. A-6:—

(a) All the leaves should be left on the seed plants, with the exception of the bottom leaves, which should disappear at priming, and of the top leaves which should be removed when the secondary shoots are cut off from the floral clusters.

(b) In order to avoid cross-fertilization and to secure pure seed, the floral clusters should be covered with a paper bag, which may be removed a few weeks later, when a sufficient number of capsules have been formed.

(c) The harvest should be done early, and all misshapen or late capsules should be cut off and thrown away.

(d) Harvesting may begin as soon as the capsules are of a brown colour, when part of the sepals are still green.

(e) The seed may be gathered by either one of the two methods, capsule by capsule or in clusters, provided the above directions are followed.

(f) The seed plants should always be sound and vigorous, perfect representatives of the type to be preserved or propagated, and selected as early as possible.

Ottawa, November, 1909.

PART II.

STERILIZATION OF SOILS.—SEED TESTS.—THICKNESS OF SEEDING.

(By F. Charlan).

Part II of Bulletin No. A—6, published in 1909 by the Tobacco Branch, contained the results of an experiment in soil sterilization conducted at the Central Experimental Farm, Ottawa. This experiment was resumed in 1909, but its scope was widened, including, this time, a test of the seeds grown on our own experimental plot, by the various methods described in Bulletin No. A—6 and in the first part of the present Bulletin. Moreover, knowing that most Canadian growers sow too thickly and in so doing not only waste their seed, but also run the risk of obtaining a crop of weak plants on their overcrowded beds, we decided to ascertain, on the bed itself, what quantity of seed should be sown on a given area.

I.—STERILIZATION OF SOILS.

As in the previous year, formalin and steam under pressure were employed; three beds were laid out and treated as follows:—

Bed No. 1. (Half A) formalin—two and a half pounds in fifty gallons of water; (Half B)—Five pounds of formalin in fifty gallons of water.

Bed No. 2. Sterilized by steam.

Bed No. 3. Good soil, of the same nature as the preceding one, but not sterilized.

The area of each plot was 126 square feet. With the exception of certain parts, where a different quantity was used in view of a test bearing on the rate of seeding, four grammes of seed were used for each hundred square feet of the seed bed. In this Bulletin the beds are designated as follows:—

F. Treated with formalin.

S. Treated with steam.

N T. Untreated.

On each bed were seven glazed frames measuring 3 x 6 feet. The following varieties were sown.

F.—TREATMENT WITH FORMALIN.

Two and a half pounds of formalin in fifty gallons of water; one gallon of the solution per square foot of seed bed—

1a. Connecticut Havana—Axillary capsules.....	9 square feet.
1b. Connecticut Havana—Ordinary capsules.....	9 “
2-3. Comstock Spanish—Imported; crop of 1907.....	36 “
4a. Comstock Spanish—Canadian seed; crop of 1908.....	9 “

Five pounds of formalin in fifty gallons of water; one gallon of the solution per square foot of seed bed—

4b. Comstock Spanish—Canadian seed; crop of 1908.....	9 square feet.
5-6. Wisconsin—Imported.....	36 “
7. Wisconsin—Canadian seed; crop of 1908..	13 “

S.—TREATMENT WITH STEAM.

1-2-3. Comstock Spanish—Canadian seed; crop of 1908.....	54	square feet.
4. Comstock Spanish—Imported; crop of 1907.....	18	"
5-6. Wisconsin—Canadian seed; crop of 1908.....	36	"
7. Wisconsin Imported.....	18	"

NT.—UNTREATED SOIL.

1. Halladay.....	18	square feet.
2. Canadian Comstock; crop of 1908:—		
(a) Seeds gathered August 20.....	4½	"
(b) Seeds gathered August 24 and 28.....	4½	"
(c) Seeds gathered September 1 and 5.....	4½	"
(d) Seeds gathered September 9.....	4½	"
3. Canadian Comstock; crop of 1908—		
XXX A-R. Seed fertilized under bags, ripened in the open air; ripe capsules.....	9	"
XXX A-½R. Seed fertilized under bags; ripened in the open air; capsules half ripe.....	9	"
4. Canadian Comstock; crop of 1908—		
X. Seed ripened entirely under bags.....	6	"
XX. Seeds ripened in the open air.....	6	"
XXX. Seeds fertilized under bags, ripened in the open air	6	"
5. Canadian Comstock; crop of 1908—		
A. Top leaves of seed plants removed.....	6	"
B. All leaves removed.....	6	"
C. Lower leaves only removed.....	6	"
6. Imported Comstock; crop of 1907—		
2.50 grammes of seed per 100 square feet.....	9	"
3 grammes of seed per 100 square feet.....	9	"
7. Imported Comstock, crop of 1907—		
3.5 grammes of seed per 100 square feet.....	9	"
4.5 grammes of seed per 100 square feet.....	9	"

The sowing was done on April 22, 1909, in hot beds, under glazed frames. Dry seeds were used.

The following observations of the seed beds were made during growth:—

MAY 13, 1909.

F.—BEDS TREATED WITH FORMALIN.

- 1a. Good bed, evenly set, plants green and strong, with four fine leaves.
- 1b. Good even bed, not quite so early as 1a.
2. Four-leaved plants, a few clumps to be thinned out.
3. Four leaves, stand a little thinner than on 2, but more evenly distributed.
4. Even stand, plants less early than on 2 and 3, four leaves. No perceptible difference between 4a and 4b.

5. Fairly even and good stand. A few plants have only two leaves as yet.
6. A little later than 5. A greater number of plants with only two leaves.
7. Many plants with only two leaves, thin bed, fairly evenly distributed.

The plants from the plot treated with the 2.5 50 solution of formalin have a good start over those of the beds treated with the 5/30 solution.

The treatment with formalin in comparatively concentrated solution seems to have the same delaying effect as the treatment by steam.

NT.—UNTREATED SOIL.

1. Four leaves, fairly even stand, well distributed, plant green and vigorous.
2. (*a-b-c*)—Average seedlings, four leaves, a few bare spots, fairly even. Thicker stand than 1 and perhaps a little earlier.
(*d*) A little late, two-leaved plants still fairly numerous.
- 3R. Fine seedlings, four leaves, even stand, well distributed. ,
½R.—Stand not half as good as R, and seems slightly later.
4. X—A little late, two-leaved plants numerous; thin stand.
XX—Good stand, four leaves, fairly well distributed.
XXX—Fairly good plants, but many bare spots.
5. A.—Four leaves, good even plants, fair stand, well distributed.
B.—Slightly inferior to A.
C.—About the same as B, fairly large bare spots.
6. 2.5 grammes—Much too thinly sown.
3 grammes—Too thinly sown.
7. 3.5 grammes—Fairly good, but a little thin.
4.5 grammes—Fairly good, sufficient.

The whole surface of the bed is covered by green mould. The soil is too wet and wants more aeration. The colour of the plant is satisfactory so far.

The beds F and NT. were weeded on the morning of the 13th. Bed No. S, free from weeds.

S.—BEDS TREATED WITH STEAM.

- 1-2-3. Four-leaved plants, but less forward than on the corresponding parts of the preceding beds. Large bare spots, mainly on 1, owing to uneven sowing. A few clumps on 2.
4. A few small clumps, fairly good stand, four leaves, fairly even stand on the whole, plant green.
5. Good seedlings; two and four leaves, the last predominating; even; good stand.
6. Large bare spots. As forward as 5.
7. Fairly good stand, evidently later than 5 and 6; most of the plants with two leaves.

The bed treated with steam is much later than the other two.

MAY 22.

F.—FORMALIN.

1a.-1b. Practically similar; plants forward. Watering should be decreased and aeration increased. Good growth.

2-3. Fine seedlings; No. 3 slightly later than No. 2; fairly thick stand.

4a.-4b. Good stand. 4b not so forward, but difference is slight.

5-6. Good but rather uneven stand.

7. Distinctly later than 5 and 6; fairly good stand.

There is a gradual decrease in the size of the plants from 1 to 7, as though the heat of the bed was less strong. The effect of the concentrated solution of formalin is certainly being felt, but the exposure of the bed and the influence of the prevailing winds must also be taken into account.

NT.—UNTREATED SOIL.

1. Fine seedlings, but later than F-1; slightly uneven stand. Plants will be ready for setting out in about fifteen days.

2. (a-b-c-d)—b and c are the best, more forward and the stand is more even; evidently a greater proportion of seeds have germinated. (a) Some parts are forward but the stand is generally thin. (d) much later than a, b, c.

3. (R and $\frac{1}{2}$ R)—R, better; in $\frac{1}{2}$ R, numerous bare spots, where even no late plants show.

4. (X-XX-XXX)—XX is the best of the three; fairly thick stand on X, but plants late; XXX, thinner stand and later plants.

5. (A-B-C)—A, good seedlings; B, fair; C, poor.

6. (2.5 grammes of seed per 100 square feet)—Insufficient quantity of seed, stand much too thin. (3 grammes per 100 square feet)—Stand very thin.

7. (3.5 grammes per 100 square feet)—Thin stand. (4.5 grammes per 100 square feet)—Rather thin stand.

S.—BEDS TREATED WITH STEAM.

1-2-3. Slow growth. Plants green, many having only six leaves; five to six days later than the corresponding part of the bed treated with formalin.

4. Fairly good bed; even; rather thin.

5-6. Uneven stand; 6 very poor; 5 must have received a larger quantity of the mixture of seed and sand which was to be evenly distributed on 5 and 6.

7. Thin stand; the latest of all.

On May 22 the leading lots are 1, 2, 3 and 4 on the bed treated with formalin; the untreated bed comes next; the bed treated with steam is quite late.

MAY 29.

F.—FORMALIN.

1a.-1b. Slight difference in favour of b, whose plants, if not earlier, are at least thicker set

2-3. Fine seedlings; good stand; a few late plants on 3.

- 4a-4b. Fine seedlings. 4a best, better growth.
 5-6. 5 fairly advanced, 6 slightly later; a few bare spots probably due to uneven sowing.
 7. Late. A great number of plants on this bed are ready for setting out.

NT.—UNTREATED SOIL.

1. Fine seedlings; this variety appears to be later than Constock Spanish and Connecticut Havana.
2. (a-b-c-d)—b and c keep their lead; fine seed bed on the whole.
3. (R- $\frac{1}{2}$ R)—Bed R is fine; large bare spots in $\frac{1}{2}$ R where the seed has not germinated.
4. X poor; XX fine. fair stand; XXX a little late.
5. A, average seedlings; B, fine; C, poor.
6. 1, thin; 2, about sufficient.
7. 1, fair stand; 2, good stand.

S.—SOIL TREATED WITH STEAM.

- 1-2-3. Fine seedlings; poorly distributed.
4. Fine seedlings; development about the same as on 1, 2, 3
- 5-6. Poorly distributed; fairly even vegetation; abundance of plants.
7. Uneven vegetation; badly distributed.

The bed treated with steam is three or four days later than the pre ; beds.

COMPARISON BY LOTS.

I.—RESULTS FROM THE TREATMENT OF SOILS.

- S-4. Plants fairly good, but not ready for setting out.
 F-2-3. Early plant, ready for setting out.
 F-7. Poor seedlings; growing on the most exposed part of the bed; deficient stand.

(S-1-2-3) (F-4)—Nearly similar, but S-1-2-3 are in the protected part of the bed, while F-4 is in the intermediate part of F, but however, it seems to be earlier. Considering the different factors affecting the test, F-4 gives better results as far as earliness is concerned.

Attention has already been called to the gradual decrease in the size of the plants from one extremity of the beds to the other.

One end of the beds, being near a hedge, was protected from the wind, while the other end, unsheltered, was exposed to a lower temperature. This is evidently the cause of the difference in growth.

II.—AGE OF THE SEED.

(S-5-6)—(S-7)—slight difference between 6 and 7; 5 more forward and more even, but occupying a better protected part of the bed.

(F-5-6)—(F-7)—Difference in favour of 5; 6 and 7 come next. Difference more pronounced between F-5 and F-7.

The greatest difference is found between F-5 and F-7; it is sufficiently marked to bear out the conclusion that, although better protection was afforded to the first lot, the two year old seed of F-5 has given better results than that of F-7, which came from the previous crop.

III.—THICK VERSUS THIN SEEDING.

(S-4)—(NT-6-7)—(F-2-3)—Sufficient quantity of seed on S-4; even stand and plant well developed. (NT-6-7)—Generally too thin, particularly on NT-6. (F-2-3)—is very fine sand, as shown in figures I and II annexed to this bulletin.

On a similar bed, sown at the rate of 4 grammes per 100 square feet, or about one-eighth of an ounce, the plants are perfectly developed, the leaves well formed, the stem white and tender, as well as thick set, and the root hairs abundant. The plant shown in figure I, and which is given as a model, has been taken from that same part of the bed. Moreover, the plants, not being too close, were equally well developed and ready for setting out at the same date, thus avoiding the necessity of selecting the plants on the bed and facilitating the pulling. The production may be estimated at a minimum of 100 plants per square foot of seed-bed. The plants growing without restraint and being sufficiently ventilated from the ground to the top, the beds are less exposed to rotting. This evil has frequently been observed, especially in the province of Quebec, and it is due as much to the excessive closeness of the stand as to lack of ventilation and excess of moisture.

The pulling of the plants was begun on the 31st of May. The plants were then 3½ to 4 inches high and were equally suited to transplantation by machine or by hand. No sign of disease was observed during the growth of the seedlings on the beds. The mould which attacked the bed whose soil had been left untreated did not seem in any way to affect the health of the young plants. It is always wise, however, to make sure to avoid diseases by sterilizing the soil.

CONCLUSIONS.

(a) It is quite evident that the steam treatment has a marked retarding effect on the growth of the seedlings, and the formalin treatment should be given the preference. The plants on the bed treated with formalin were slow at the start, but they rapidly overtook the plants of the untreated bed and, being the earliest, were the first to be pulled for setting out. Therefore, from the point of view of earliness, the formalin treatment cannot be too strongly recommended.

The treatment with formalin does not destroy the weed seeds that may lie in the soil, and the treatment with steam is more effective for that purpose. But with proper care and careful preparation of the soil, tobacco growers can obtain beds containing very few weeds. For careful farmers, who always give great care to the preparation of the beds, the formalin treatment, although it may make weeding necessary, is more advantageous, and easier to apply, as it does not require a steam generator, a machine which is not found upon every farm.

While recognizing the merits of the steam treatment, we feel, after a two years' test, that the treatment with formalin is the best, as it is cheaper and more easily applied. A solution of 2½ pounds of formalin in 50 gallons of water, applied at the rate of one gallon per square foot of bed, seems to be sufficient. In doubtful cases it

may be made double strength, but this may cause some little delay in the germination and the first growth of the young plants.

(b) The age of the seed is not an indifferent consideration. With time the tobacco seed loses part of its vitality, but experience has shown that seed ten years old, and even older, may give excellent results. The best results are obtained from seed two to six years old, whose formation is completed and whose vitality is still unimpaired. The tobacco grower anxious as to the future of his crop, and therefore the success of his seed-beds, would act wisely in keeping in reserve a stock of seeds grown in the most favourable years and which he will use for five or six years. It will be prudent to renew this stock after that lapse of time. The use of the seeds derived from the previous crop should be avoided as much as possible.

(c) The tobacco grower should keep in mind the fact that many troubles arise from too thick seeding, such as disease of seedlings, tapering and yellowing of the plants, etc., which, occurring at the beginning of the season, have invariably an injurious influence on the crop. In our own test, one-seventh of an ounce of seed was sown per hundred square feet and at this rate gave a very fine stand. But the quantity of seed will vary with the percentage of germination (in our test the proportion was about 90 per cent); if the percentage is low, more seed will have to be used. However, we think the above rate should be followed as closely as possible.

(d) The last observation made (F-1a, 1b) shows a slight difference in favour of the Connecticut Havana plant grown from seeds of ordinary capsules. Although the axillary capsules give earlier plants, (and the difference is practically insignificant) the plants are less thick set and therefore a little less vigorous, which is a serious drawback, not sufficiently offset by the difference in earliness.

On the other hand the test made in our experimental plot shows a yield of 1,161 pounds per acre for the plants grown from seeds out of axillary capsules and of 1,591 lbs. for the plants grown from seeds out of other capsules. It is therefore evident that such seeds must be preferred to all others, except in special research work. We therefore insist on the advice already given of cleaning carefully the floral clusters when the protecting bags are removed and of cutting off and throwing away all axillary capsules not perfectly formed.

(e) With regard to the time of harvest, better results will be obtained if the seed (at least that of a recent crop) (NT-2) (a, b, c, d) is harvested in a certain period, during which the climatic conditions are most favourable; the length of this period varies with the districts and the growing seasons.

No late capsules, and, among early capsules, none of those which appear to be imperfectly formed should be harvested. Lot NT-2 (a) undoubtedly contained a fairly high proportion of seeds from these poor capsules, some of which were axillary, and the final yield was affected thereby.

This bears out the recommendations made on the subject of seed growing, in our Bulletin No. A-6 (Part I), and repeated in the first part of this Bulletin.

OTTAWA, November, 1909.

PART III.

THE VALUE TO CANADIAN FARMERS OF HOME-GROWN TOBACCO SEED.

(By F. Charlan).

The results of experiments in growing tobacco carried on in 1909 at the Central Experimental Farm, Ottawa, and for which we had to use seeds of widely different variety and origin, show, in a striking manner, the advantage of using home-grown seeds, from acclimatized varieties, and selected with a view to bring about a gradual improvement in varieties.

In the first place, let us condemn the practice, common to many growers, of frequently changing varieties. Because a variety of tobacco, tried for the first time, has not given satisfactory results—and there may be numerous causes for such failure—any seed catalogue is opened and, upon the authority of the advertisement, a new variety is tried which is still less adapted to our soil and climatic conditions, or for which there is no demand on the market, thus courting another failure.

A common mistake is to believe that nearly all the varieties of tobacco may be grown in Canada, provided the soils are judiciously selected. Of course, the various regions of this immense Dominion, present great differences of climate, and the tobacco growing districts in these regions may yield entirely different products, but the number of varieties which may be profitably grown is far from being unlimited.

In Canada, at the present time, it is more logical to confine the growing of tobacco to the production of American types—those grown in the northern and eastern parts of the United States—provided, however, that such types are recognized as susceptible of adaptation to our conditions. Among these varieties may be included the Burleys for Ontario, and the Seed Leafs for Quebec, this province having specialized in the production of small Canadian tobaccos. Exception might be made for British Columbia. Climatic conditions particularly favourable have encouraged the growing of Cuban in the Okanagan Valley, but it must be said, however, that in spite of many endeavours, this industry is still in the embryo stage and has not developed as well as could have been expected from the quality of the product.

It is important that the growers of Canadian tobaccos, who still form but a relatively small group, should not devote their attention to too many varieties.

Types and not varieties is the need of the tobacco industry, in Canada as well as in other countries, and when a regular supply of products suitable for the manufacture of cut and plug tobaccos, or of cigars and cigarettes, will be offered at advantageous prices to our manufacturers, they will give little heed to the name of the varieties, provided these belong to the right type.

Because seeds of any kind may be imported, (Algeria, Jamaica, Vuelta Abajo, Xanthi, etc.), a seed-bed established and a more or less successful plantation made, it does not follow that all those varieties may be grown with profit in Canada. The products should first be compared with those obtained in the countries where the varieties originated, a comparison that might not always be favourable. On the other hand the cost of production is a serious consideration, while the opinion of the manufacturer, leaving aside that of the consumer, is an important factor.

The Canadian industry having been supplied, at the beginning, with foreign tobaccos, and the public taste having long been formed, it is wise for the Canadian planters to grow those tobaccos only which, with the protection recently granted to the indigenous product, may replace one or more of their imported competitors. This result has been attained, as yet, only by the Burleys of Ontario, and a few of the Seed Leafs of Quebec. It should be stated also that these are the most promising types, because there is a greater manufacturing demand for them. Thus, we know what types to grow. But amongst these, what varieties are the most suitable for the manufacturer and most profitable for the grower?

In spite of the criticism expressed above, we are pleased to see that for some time, at least in those countries where tobacco culture is improving, there has been a tendency to grow those varieties only which are the best suited to the conditions of the soil and climate and for which there is a special demand from the manufacturer.

This last factor, long neglected by the Quebec farmer, is becoming more and more important since home products have been officially admitted into some of the largest manufactures of the country, and the grower must get used to the idea that he will have to reckon with the manufacturer in the future.

Owing to the present condition of the tobacco trade in Canada, the small Canadian varieties, such as Canelle, Petit Rouge, Small Havana, etc., are not considered as manufacturing tobaccos. They are not submitted to any special treatment and are practically excluded from the manufactures. However, they are not an indifferent quantity, as they cater to a fairly numerous class of customers, who, either for their aroma (which is a quality), or for their strength, due to their high nicotine contents (a defect which in time is not noticeable), prefer them to all others. Many farmers make a living out of the growing of these varieties.

We now come to the Seed Leafs. The Connecticut Seed Leaf is a heavy yielder on some soils, but being slow in ripening can be recommended only for places where it can be sown very early, so that it can be harvested in time to avoid frost, either on the field or in the curing sheds. If these sheds are tightly built, fire may be used, when necessary, to complete the curing of the products before the winter, but the most serious objection to this variety in Canada is that it is a slow grower and must be harvested late.

This defect is well known to many growers, who have observed it to their own cost, and an endeavour has been made to replace the large Connecticut by other varieties, which, if not as prolific, at least ripen earlier. For this reason the Havana Seed Leaf has gradually replaced the Connecticut Seed Leaf, which, in turn, has been replaced by the Comstock Spanish, imported from Wisconsin, a still earlier variety. In the counties of Montcalm, Joliette, Assomption, Rouville, etc., this last variety has given fine leaves, supple and resistant, of good average size and well adapted to the manufacture of binders.

Thus, beginning with a light cigar variety, the Connecticut Seed Leaf, (which under different conditions slowly degenerated into a rather strong pipe tobacco), the Quebec growers finally adopted the Comstock Spanish, a smaller but earlier variety, whose products in Canada are truer to type than those of the Connecticut Seed Leaf, and even lighter than in the country where it originated. Thus, guided by the exigencies of their climates, the Quebec growers have accomplished, unconsciously, a natural selection and made a fairly definite selection of the most profitable variety.

The introduction of Comstocks in the county of Montcalm, following a tour of investigation in Wisconsin, marks a new era for the growers of Quebec. The final stage has been reached when the products of this variety were utilized as binders, in the manufacture of cigars, and they can now be classed as manufacturing products.

It is to be hoped that Canadian growers will realize the great future in store for this variety and will bend their energies to the task of improving it, instead of going back, as some of them are inclined to do, to varieties with heavy yields, but of slower growth and more exposed to injury.

It has been said that Canadian Comstocks are not sufficiently productive, but this is not correct. The exhaustion of soils by continuous cropping, poor manuring, poor care of the crop, setting out too far apart, all these could be incriminated with more reason. On good soils and with sufficient care, many growers are now getting, in normal years, average yields of from 1,200 to 1,400 pounds per acre.

In Ontario, guided by the manufacturers, the growers have from the start adopted the Burley variety.

Soil and climatic conditions in this part of Canada favour the growing of this variety, which, however, might be further improved. It could be made more resistant to diseases which have made an appearance in recent years, and rendered more productive. This may undoubtedly be obtained by proper selection and better methods of culture, based on a good rotation of crops.

The attention of Essex growers has recently been called to the possibility of growing Virginia Bright tobaccos on some particular soils. A few farmers are now growing this variety and practising flue curing. Such tests, backed by some manufacturers who are ready to start a new industry, are highly interesting. But it would be very unwise to try a large number of varieties with no sure prospect of a market for the same. We think it is very important that each district should specialize in the production of a particular type. This, in our opinion, is the only way by which our products can gain a reputation and meet with a ready sale.

* * * * *

At the beginning of our operations, we were struck by the lack of definite type in the varieties grown by the farmers, who produce their own seed, and, as others had done before us, we attributed this defect to degeneration, caused by unfavourable climatic conditions.

Since then, we have proved that under suitable conditions, tobacco seeds produced in Canada have perpetuated the characteristics of their respective varieties, quite as well as imported seeds have perpetuated theirs, and, not only so, but—after acclimatization, which is possible for a few varieties—they can produce earlier or hardier plants, which are preferable to others.

One of the objects of the test undertaken in 1900 at the Central Experimental Farm, Ottawa, was to compare the results obtained from imported seed on the one hand and from seed grown in Canada from imported seed during the previous year.

The Following Varieties were Tested:

1. A selection of Wisconsin imported from the experimental farm of Wisconsin.
2. Seed produced at our experimental farm the previous year, at a preliminary test of the same variety.

3. A Comstock Spanish, also imported from Wisconsin and tested for several years in Canada with excellent results.

4. Seed produced in Canada, in 1908, on a plantation of Comstock Spanish.

To find out the influence of climate on certain varieties, two sorts of tobaccos, highly appreciated in Connecticut, were also grown, viz:—1. A selection of Connecticut Havana; 2. Halladay, a hybrid of recent date, not entirely fixed as yet, but from which American experts hope to obtain the best results, both in quality of texture and in yield. The seeds of these two varieties were kindly supplied by the Department of Agriculture at Washington.

Connecticut Havana.—It was thought that this was a selected Seed Leaf. The test showed that it is a hybrid of Havana Seed Leaf and Connecticut Seed Leaf. The upper half is practically pure Havana Seed Leaf; in the lower half, the leaves, although smaller than those of the Connecticut Seed Leaf, are drooping and elongated in shape, clearly recalling the leaves of the Connecticut Seed Leaf.

This variety has shown itself very sensitive to blight, or Mosaic disease, on plots where Comstock Spanish and Wisconsin had thrived.

Halladay.—This hybrid, which is highly recommended in Connecticut, does not seem to be adapted to our climatic conditions. Its development is shown in figure VIII, where the 'havanensis' blood is clearly seen to predominate. The leaf is small compared with that of the Comstock and is slightly lacking in fineness of tissue, although the ribs are very little prominent. This is a rather gummy tobacco, assuming a bronze green colour in the curing-shed and rather better suited for fillers than for wrappers. It is not certain, however, that its aroma is good enough so that it can be recommended in place of the Cubans and Hazlewoods.

The above varieties may be very interesting for American growers, but they are of very little importance for Canadian growers. They may be further studied in experimental stations and an endeavour made to acclimatize them as much as possible, but they should be avoided by the Canadian grower on account of their lack of hardiness under our climate, their poor adaptation to our soils, and the risks incurred in growing tobaccos that are not only susceptible of rapid degeneration, but moreover unable to produce sufficient yields, even when the seeds are renewed every year.

Let us now see the results obtained from varieties also imported, but susceptible of acclimatization in Canada.

Wisconsin Special—Imported Seed.—The plants were set at a distance of 3 feet by 1½ feet and the yield reached 1,163 pounds per acre.

The plant is vigorous and has a fine appearance; the leaves are close to the stem, of good size and good shape. See figure IX.

Canadian Wisconsin.—Has kept the characters of the preceding one, but seems more vigorous; the yield, under the same conditions of culture, has reached 1,241 pounds per acre.

Imported Comstock Spanish.—This tobacco has about the same appearance as the preceding one, but the leaf is more graceful and the ribs much more delicate, figure IX. The yield, with the plants set at a distance of 2½ feet by 1½ feet, has been 1,101 pounds per acre in 1909.

Canadian Comstock Spanish.—Has the physical characters of the preceding one, but a more luxurious vegetation; the yield reaches 1,471 pounds per acre.

The year 1909 cannot be said to have been a favourable one to tobacco culture. The above varieties generally produce much heavier yields, and in previous years have given as much as 1,800 to 1,900 pounds. But it is evident that in both cases the difference is in favour of the seed produced in Canada. We have therefore a product perfectly acclimatized.

By the use of home-grown seeds one is able to make a careful selection and to ascertain the quality of the seed, which the foreign dealer does not guarantee. This selection may bring about a gradual improvement of the types and probably the establishment of truly Canadian varieties, as hardy as some of the small tobaccos grown from time immemorial in the province of Quebec (Canelle, Petit Havane, etc.).

The possibility of producing our own seed—thereby becoming independent—being clearly established, we urge the growing of tobacco seeds upon all Canadian growers. But we must insist upon adherence to the instructions given in our previous bulletins, as otherwise, instead of their rapidly producing acclimatized and pure types, the best imported varieties will speedily degenerate.

OTTAWA, November, 1909.



Figure 1. Seedlings of Constock Spanish. (Bed sown at the rate of $\frac{1}{4}$ of an ounce per 100 square feet.)





Figure 11.—Seedlings of Constock Spanish. (Bed sown at the rate of $\frac{1}{4}$ of an ounce per 100 square feet.)



Figure III.- Sterilization of soils. (Showing the interior arrangement of the box used. The generator is seen at the back)

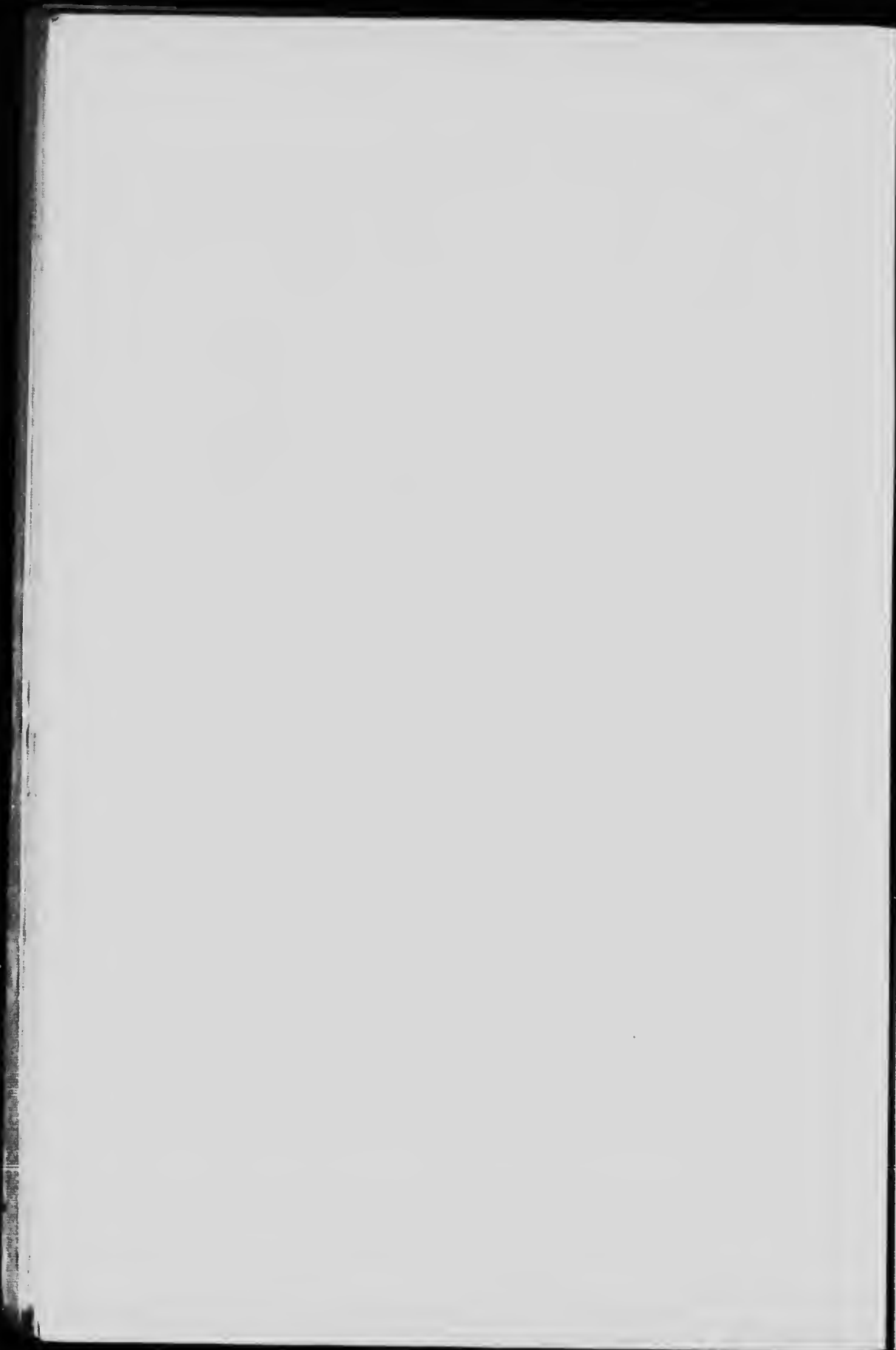




Figure IV. Sterilization of soils. (Steam is forced, for 30 minutes, into the closed box which is filled with soil to be treated.)



Figure V. — Seed plant, ready to be covered by the protecting bag.

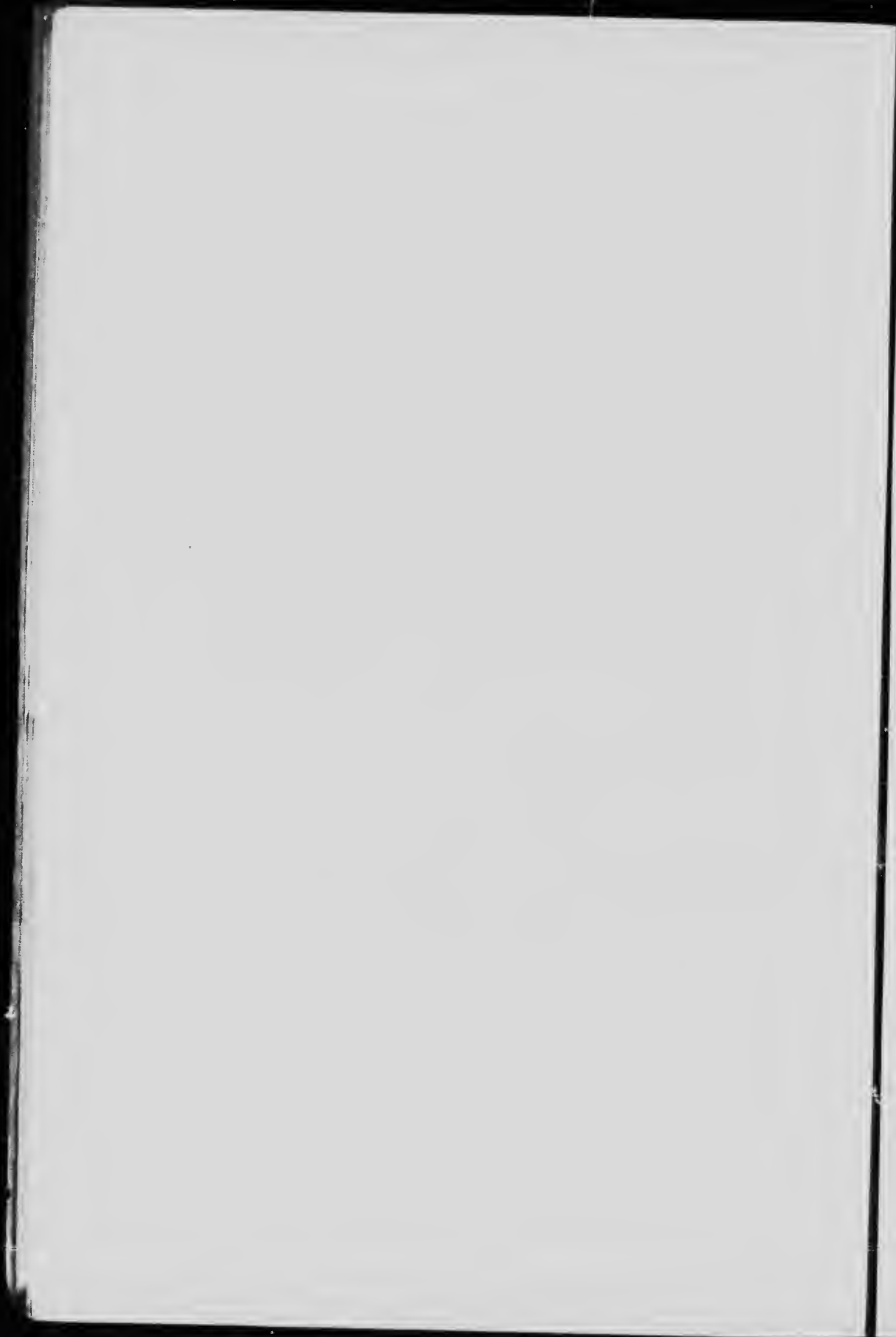




Figure VI. Seed plant covered by the protecting bag to prevent cross-fertilization.



Figure VII. Seed plant after cleaning. (The bag has been removed, the top leaves, the secondary shoots and the lower leaves have been cut off.)

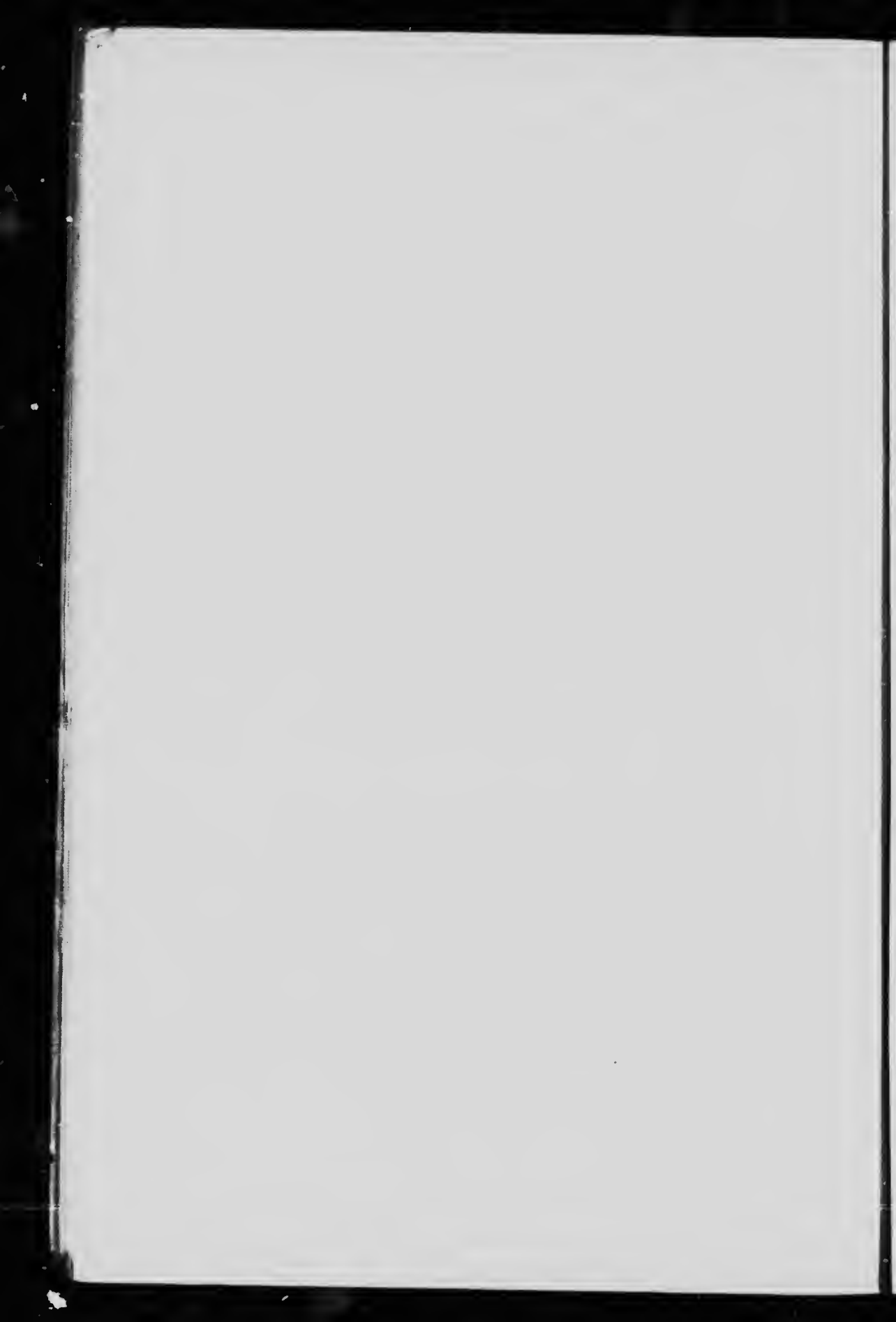
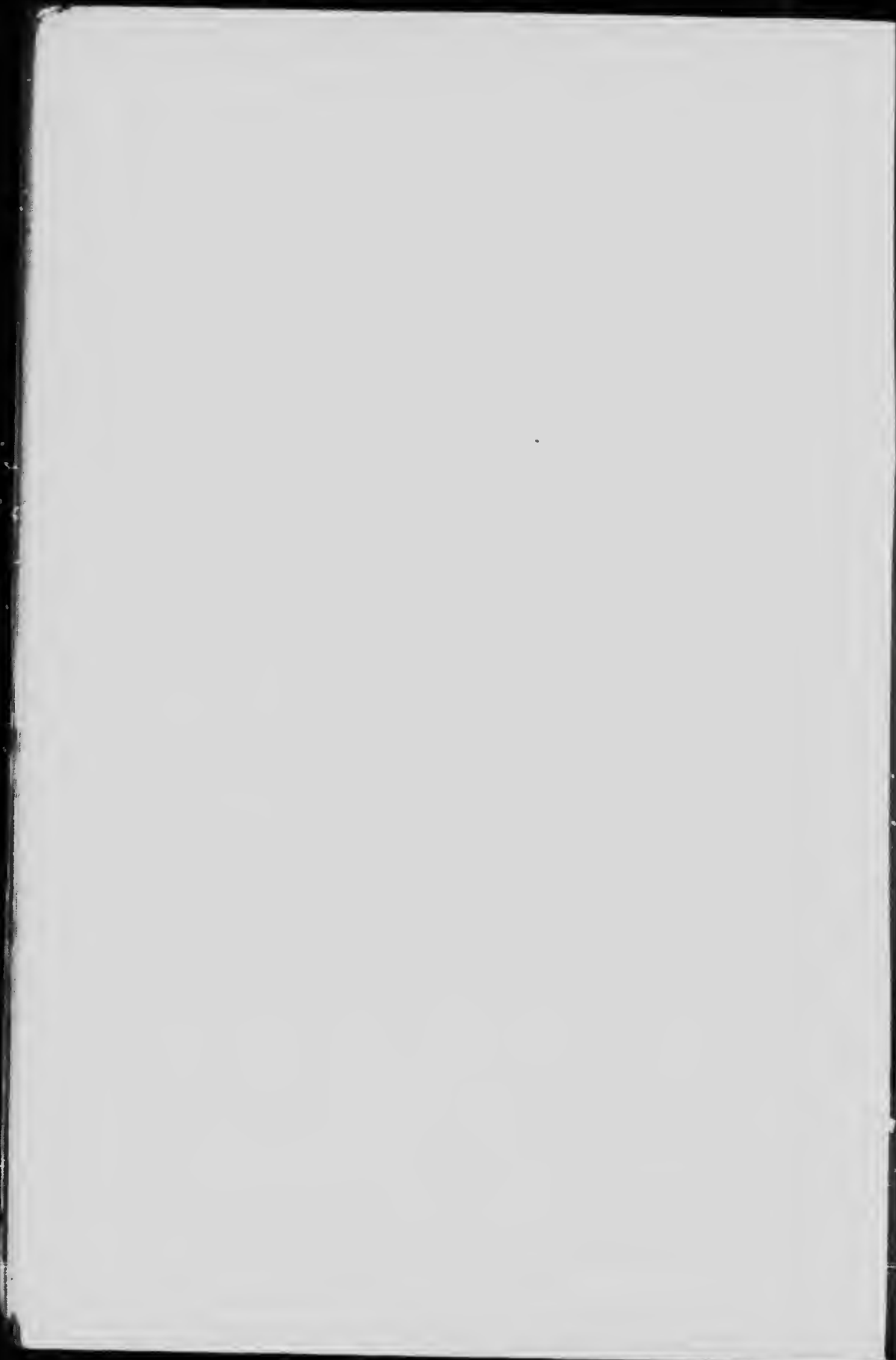




Figure VIII.—Halladay. (Protected by paper bags for the production of choice seeds.)





(1) MISSISSIPPI.

Figure IX.—Showing the finer texture and more elegant shape of the



(2) GORSTOCK SPANISH.

of the Gorstock Spanish.



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