UMLD

THESIS

378.7M71

XC64

UM Libraries Depository

104034103005

This Thesis Has Been

MICROFILMED

Negative No. T-

268

Form 26

SOME PROBLEMS IN SEED GERMINATION
AND
IN THE PHYSIOLOGY OF TRANSPLANTING.

- - - oOo - - -

A Thesis Submitted by

Mary A. ^{alice} Cochel,

As Part of the Requirements for the Degree of

M A S T E R O F S C I E N C E .

- - - oOo - - -

378.7M71
XC64

The data that will be given in the following paper have been collected from various experiments carried on by the writer during the school year of 1906-1907. They go to show the progress of the various tests, the results of which should be expected under similar methods and conditions, rather than a report of stated facts.

Object in View.

To test the germinating power of various seeds, to determine whether large or small seeds produce the better plants for transplanting, whether the best seeds have a definite location in the plant.

To determine just what plants or seedlings seem to thrive better when more or less wilted prior to transplanting.

To determine what happens when plants are wilted, particularly those benefited by this process in transplanting.

The wilting may cause death of the root-hairs, and it may be easier for the transplanted plant to develop new root-hairs than to restore those only partially injured, as might be the case if wilting were not given. Again, it may be that this wilting is injurious to roots or rootlets rather than to the root-hairs, and that it is more economical to develop new roots, and that the vigor of the plant may go toward this more easily where the old roots have, at the tips, at least, been strongly wilted. In the third place, it is possible that the process of flaccidity merely acts in this way, viz., that the plant is passive at the outset in its new environment, and consequently does not undergo what might be termed the strain of rapid transpiration after being transplanted.

Plan of the Investigation.

It was decided to use simple methods in each case, in order to make the conditions of the investigation available to the average gardener as far as possible.

In determination of each test, plants adapted to this section of country were used.

Selection and Variety of Seed Used.

<u>Selection.</u>	<u>Variety.</u>
Lettuce.....	Black seeded forcing; Big Boston; St. Louis Butter.
Cabbage.....	Flat Dutch Selected; Early Jersey Wakefield.
Cauliflower.....	Earliest Dwarf Erfurt.
Cucumber.....	Green Hybrid; White Spine.
Radish.....	Red White Tip; Early Red Globe.
Tomato.....	Freedom; Trophy.
Corn.....	Boone County White; Leaming; Silvermine; Reid's Yellow Dent.

All seeds used in the investigation, with the exception of Tomatoes and Corn, were purchased of Joseph Goeke, 1817 Wash Street, St. Louis, Missouri.

Greenhouse, etc.

The greenhouse in which the investigation was carried on is the regular Horticultural greenhouse used by students in experimental work.

Dimensions: 16 x 60;

6 ft. 6 in. from ground to eaves;

10 ft. 6 in. " " " gable;

3 ft. 3 in. brick wall from ground to
glass in frames.

Propagating benches: 3 ft. 3 in. from ground;
10 in. deep.

The benches are made of wood, and are filled
with coarse sand.

The temperature varies from 65° to 85°.

Seed Tests.

Vegetative power of heavy versus light seed.

Plan:---

One hundred large seed and one hundred small seed
were selected for each test, and weight of each lot of
seed was recorded.

All seeds were planted under the same conditions,
as near as was possible.

Flats (18" x 12" x 4") were used in some of the
tests, while six-inch pots were used in others, ac-
cording to the decision of the writer.

Flats and pots were filled with common gardeners'
soil or coarse sand (washed), owing to the nature of
the test.

Treatment of Seed.

All seeds to be used were carefully selected, and the same number of seed planted in each flat or pot, the distance being approximately equal between all seed. After planting the seed, from one to one and one-half inches of coarse sand was placed on top of soil. A record of each test was kept, as to date of first germinating seed, last germinating seed, date of transplanting, etc., as will be seen from various tables to follow.

Plants.

After the majority of seeds in each test had germinated, and the plants had developed their true leaves, then the plants were transplanted into flats or pots, according to their previous treatment. Each plant was allowed to grow for a certain period, which period in most tests lasted one month. At the end of the period, each lot of plants was carefully removed from soil or sand, and apparently freed from soil particles, care being taken not to destroy the root systems, which in some cases was almost impossible.

Weights were taken of the tops, and in a number of tests the root weight was also taken, and

a general average made of each test, as will be seen from the following tables showing results of various tests.

Vegetative power of heavy versus light seeds.

T A B L E I.

Selection.....Lettuce

Variety.....Black Seeded Forcing.

Number seed used....One hundred.

These seed were planted in six-inch pots, plants kept turgid, and watered as would a gardener water plants.

Test I.

	wgt of seed.	Planted	1st Seed up.	Transplanted	% Germinated	Final wgt.	Top wgt.	root wgt	Total wgt	Average wgt per plant
Light	.330	Nov. 26	Nov. 29	Dec. 11	90	Dec 24	28.50	3.810	32.310	.361
	.340	Nov 26	Nov 29	Nov 12	80	Dec 24	26.34	3.686	30.026	.375
Heavy	.369	Nov 26	Nov 29	Dec 11	47	Dec 24	13.05	.927	13.977	.297
	.372	" 26	" 29	Dec 12	60	Dec 24	19.50	.801	21.301	.355

Test II.

	Wgt of seed	Planted	1st Seed up.	Transplanted	% Germinated	Final Wgt.	Top wgt.	root wgt	Total wgt.	Avg. wgt per plant.
L.	342	Dec 1	Dec 5	Dec 17	85	Jan 1	28.71	3.800	32.500	.3820
H.	360	" 1	" 5	Dec 17	50	Jan 1	18.19	1.061	19.251	.3850

Result:

Greater percent of light weight seed germinated.

In Test I. light seed averaged the heavier plants.

In Test II. heavy seed averaged the heavier plants.

Germination of first seed same in each test.

T A B L E I I.

Selection.....Lettuce.

Variety.....Big Boston.

Number seed used...One hundred.

Seeds in this test were planted in flats; common gardeners' soil used.

Test I.

	PWgt of Seed	Planted	1st Seed up	Transplanted	% Germinated	Final wgt	Top wgt.	rt. wgt	Total wgt	wgt Per. Plant.
L.	.395	Nov 26	Dec. 3.	Dec 10	44	Jan 10.	21.30	2.500	23.80	.540
H.	.415	Nov. 26	Nov 29.	Dec 10	59	Jan 10.	23.05	1.881	24.93	.422

Test II.

L	.380	Dec 7	Dec 15	Dec 18	48	Jan 7	25.60	3.00	28.60	.595
H	.430	Dec 7	Dec 11	Dec 18	60	Jan 7	30.00	2.50	32.50	.541

Test III.

L	.360	Jan 3	Jan 10	Jan 25	48	Feb 8	30.00	2.80	32.80	.683
H	.420	Jan 3	Jan 8	Jan 25	70	Feb 8	48.00	2.90	50.90	.729

Test IV.

L	.370	Feb 10	Feb 24	Feb 27	40	Mar 10	24.60	2.40	27.00	.675
H	.416	Feb 10	Feb 15	Feb 27	50	Mar 10	29.86	2.30	32.16	.643

Result:

Light seed germinated first.

Heavy seed matured first in all but Test III.

Heavy seed produced greater percent. of plants.

Light seed produced better plants in all but Test III.

T A B L E I I I.

Selection.....Cabbage.

Variety.....Flat Dutch.

Number seed used.....One Hundred. Wt. in grams.

In this series of tests, flats were used both in germination and transplanting. Plants were transplanted at end of first month, the average distance being 3 inches each way.

Test I.

	Wgt of Seed.	Planted	1st Seed up.	Transplanted	% Germinated	Final wgt	Top wgt	Root wgt	Total wgt.	Wgt Per Plant.
L	287	Oct. 17	Oct 24	Oct 30	80	Nov 17	76.0	4.00	80.00	1.00
H	446	Oct. 17	Oct 26	Oct 30	85	Nov 17	90.0	7.00	97.00	1.14+

Test II.

	Wgt of Seed.	Planted	1st Seed up.	Transplanted	% Germinated	Final wgt	Top wgt	Root wgt	Total wgt.	Wgt Per Plant.
L	274	Oct 30	Nov 5	Nov 12	68	Nov 30	89.5	6.5	96.00	1.41+
H	440	Oct 30	.. 8	Nov 12	90	Nov 30	120.0	7.8	127.80	1.42

Test III.

	Wgt of Seed.	Planted	1st Seed up.	Transplanted	% Germinated	Final wgt	Top wgt	Root wgt	Total wgt.	Wgt Per Plant.
L	260	Nov 30	Dec 5	Dec 13	85	Dec 30	88.3	7.7	96.0	1.12+
H	400	Nov 30	Dec 6	Dec 13	70	Dec 30	74.2	5.0	79.2	1.13+

Result:

Light seed germinated first.

Heavy seed produced the greatest percent of plants.

Heavy seed produced the better plants.

The average of heavy seed (top weight) per plant = 1.16 grams.

The average of light seed (top weight) per plant = 1.089 grams.

Selection..... Cabbage

Variety..... Early Jersey Wakefield.

Number seed used..... One hundred. Wt. in grams

Test I.

	wgt of seed	Planted.	First seed up	Transplanted	% Germinated	Final wgt	Top wgt	Root wgt.	Total wgt	Avg. Wgt. Per Plant.
L	.254	Oct 17	Oct 23	Nov 1.	70	Nov 17	65.00	4.20	69.20	.988
H	.360	Oct 17	Oct 26	Nov 1.	90	Nov 17	92.00	5.00	97.00	1.07

Test II.

	wgt of seed	Planted.	First seed up	Transplanted	% Germinated	Final wgt	Top wgt	Root wgt.	Total wgt	Avg. Wgt. Per Plant.
L	.260	Nov 30	Dec 4	Dec 16	73	Dec 30	74.32	6.12	80.44	1.101
H	.405	Nov 30	Dec 6	Dec 16	94	Dec 30	154.53	7.30	161.83	1.742

Result:

Light seed germinated first.

Heavy seed produced the greater percent. of plants.

Heavy seed produced the better plants.

Average of heavy seed (top weight) per plant, 1.339.

Average of light seed (top weight) per plant, .973.

T A B L E I V.

Selection.....Cauliflower.

Variety.....Earliest Dwarf Erfurt.

Number seed used.....One hundred.

Weight taken in grams.

Flats used for germinating and transplanting.

Test I.

	wgt of seed	Planted	First seed up.	Transplanted	% germinated	Final wgt.	Top wgt	root wgt.	Total	Av wgt Per Plant.
L	.565	Oct 26	Oct 29	Nov 7	90	Nov 26	40.50	1.85	42.35	.4705
H	.740	Oct 26	Oct 29	Nov 7	95	Nov 26	48.00	1.75	49.75	.5236

Test II.

L	.550	Nov 24	Nov 29	Dec 9	70	Dec 24	22.30	.95	23.25	.3321+
	.574	Nov 24	Nov 29	Dec 4	47	Dec 24	20.37	1.60	21.97	.4674
H	.728	Nov 24	Nov 27	Dec 4	55	Dec 24	22.00	.97	22.97	.4176
	.730	Nov 24	Nov 28	Dec 9	60	Dec 24	25.40	.60	26.00	.4333

Test III.

L	.500	Dec 1	Dec 5	Dec 12	80	Jan 1	38.50	1.50	40.00	.500
H	.730	Dec 1	Dec 4	Dec 12	84	Jan 1	47.65	.84	48.49	.577+

Result:

Light seed germinated first.

Heavy seed produced greater percent. of plants.

Average of heavy seed (top weight) per plant =.4861.

Average of light seed (top weight) per plant =.4239.

T A B L E V.

Selection.....Cucumber.

Variety.....Green Hybrid.

Number seed used.....One hundred.

Weight in grams.

Flats used for germinating and transplanting.

Test I.

	Wgt of seed	Planted	First seed up	Transplanted	% Germinated	Final wgt	Top wgt.	Avg wgt Root plant.	Total wgt	Avg. wgt Per plant.
L	1.880	Feb 27	Mar 1	Mar 6	34	Mar 27	74.	—	74.	2.16
H	3.373	Feb 27	Mar 2	Mar 6	50	Mar 27	150.	—	150.	3.00

Test II.

L	2.001	Mar 27	Apr 2	Apr 6	41	Apr 27	82.	—	82.	2.00
	2.102	Mar 27	Apr 1	Apr 6	45	Apr 27	120.	—	120.	2.66
H	3.421	Mar 27	Apr 3	Apr 6	52	Apr 27	167.	—	167.	3.21
	3.446	Mar 27	Apr 3	Apr 6	76	Apr 27	241.	—	241.	3.17

Test III.

L	1.745	Mar 29	Apr 3	Apr 8	37.	Apr 29	102.	—	102	2.75
H	3.001	Mar 29	Apr 4	Apr 8	28.	Apr 29	54	—	54	1.86

Result:

Light Seed germinated first.

Heavy seed produced greater percent. of plants.

Average of heavy seed (top weight) per plant =2.970.

Average of light seed (top weight) per plant =2.407.

T A B L E V I.

Selection.....Radish.

Variety.....Early Red Globe.

Number seed used.....One hundred.

Six inch pots used.

Test I.

	Wgt of Seed	Planted.	First seed up.	Transplanted	% Germinated	Final Wgt.	Top Wgt.	Root Wgt	Total Wgt	Ave. Wgt. per Plant.
L	1.025	Nov. 4	Nov 7/	Nov 21	60	Dec 21	38.210	4.30	42.51	.7085
	1.096	Nov. 4	Nov 12	Nov 21	40	Dec 21	30.820	4.70	36.52	.8880
	1.754	Nov 4	Nov 13	Nov 21	55	Dec 21	40.95	5.00	45.95	.8354
H	1.946	Nov 4	Nov 12	Nov 21	65	Dec 21	46.80	4.70	51.50	.7923

Test II.

L	.716	Nov 24	Nov 29	Dec 16	42	Jan 16	34.607	4.26	38.867	.9254
H	2.00	Nov 24	Nov 29	Dec 16	27	Jan 16	23.714	3.55	27.265	1.098

Test III.

L	.964	Dec 24	Dec 30	Jan 8	53	Feb 8	35.000	5.00	40.000	.7547
H	1.982	Dec 24	Dec 29	Jan 8	60	Feb 8	34.212	4.72	38.932	.6488

Test IV.

L	.850	Jan 31	Feb 4	Feb 10	50	Mar 10	46.210	6.48	52.690	1.0538
H	1.485	Jan 31	Feb 5	Feb 10	36	Mar 10	36.540	8.60	45.140	1.2538

Result:

Light seed germinated first in Test II.- lot 1.

Light seed germinated first in Test IV.

Heavy seed germinated first in Test III.

Light and heavy seed germinated same day in

Test I. and Test II.- lot 1.

Heavy seed produced greater percent. of plants.

Average of heavy seed (top weight) per plant = .7338.

Average of light seed (top weight) per plant = .7409.

Selection.....Radish.

Variety.....Red White Tip.

Number seed used.....One hundred.

Flats were used.

Test I.

	Wgt of seed.	Planted.	First seed up	Transplanted	% Germinated	Final wgt.	Top wgt.	Root wgt.	Total wgt	Wgt Per Plant.
L	.710	Nov 24	Nov 30	Dec 11	87	Jan 11	100.921	9.00	109.121	1.265
H	1.203	Nov 24	Dec 2	Dec 11	90	Jan 11	126.050	8.10	134.150	1.495

Test II.

L	.800	Dec 4	Dec 10	Dec 16	80	Jan 11	91.001	8.02	99.021	1.23
H	1.110	Dec 4	Dec 11	Dec 16	83	Jan 11	107.061	7.04	108.091	1.302

Test III.

L	.762	Jan 31	Feb 4	Feb 15	50	Mar 15	50.001	4.52	54.521	1.0904
H	1.002	Jan 31	Feb 5	Feb 15	60	Mar 15	68.023	5.63	73.653	1.2275

Result:

Light seed germinated first.

Heavy seed produced greater percent. of plants.

Average of heavy seed (top weight) per plant = 1.255.

Average of light seed (top weight) per plant = 1.111.

T A B L E V I I .

Selection.....Tomato.

Variety.....Freedom.

Number seed used.....One hundred.

Six inch pots were used for germinating seed.

Flats were used for transplanting plants.

Weight in grams.

Test I.

	<i>Wgt of seed</i>	<i>Planted</i>	<i>First seed up</i>	<i>Transplanted</i>	<i>% Germinated</i>	<i>Final wgt.</i>	<i>Top wgt.</i>	<i>Root wgt</i>	<i>Total wgt</i>	<i>Wgt per Plant.</i>
L	.150	Oct 23	Oct 28	Nov 10	60	Nov 23	70	—	70	1.166
	.165	Oct 23	Oct 25	Nov 11	50	Nov 23	64	—	64	1.289
H	.261	Oct 23	Oct 31	Nov 10	70	Nov 23	90	—	90	1.285
	.282	Oct 23	Oct 29	Nov 11	75	Nov 23	93	—	93	1.240

Test II.

L	.100	Oct 30	Nov 8	Nov 14	67	Nov 30	86	—	86	1.283
H	.331	Oct 30	Nov 6	Nov 14	78	Nov 30	101	—	101	1.294

Test III.

L	.143	Dec 1	Dec 11	Dec 18	80	Jan 1	112	—	112	1.40
	.251	Dec 1	Dec 8	Dec 18	48	Jan 1	91	—	91	1.895
H	.324	Dec 1	Dec 7	Dec 18	93	Jan 1	127	—	127	1.365
	.363	Dec 1	Dec 8	Dec 18	42	Jan 1	111	—	111	2.642.

Result:

Heavy seed germinated first, except in Test III.— lot 1

Light and heavy seeds germinated on same day.

Heavy seeds produced greater percent. of plants.

Average of heavy seed (top weight) per plant = 1.458.

Average of light seed (top weight) per plant = 1.405.

Conclusion for:

Germinating power of various seeds, to determine whether large or small seed produce the better plants for transplanting.

In this phase of the investigation:

Light seeds germinated earlier than did the heavy seeds.

Heavy seeds produced greater percent. of plants.

Heavy seeds produced stocky plants.

Heavy seeds produced the weightier plants.

This being true, the writer considers plants produced from heavy seed make the better plants for transplanting.

COMPARATIVE GROWTH OF WILTED AND TURGID PLANTS
PREVIOUS TO TRANSPLANTING.

These data have been collected from various investigations, in which the writer tried to determine just what plants or seedlings seem to thrive better when being transplanted, also to determine what happens when plants are wilted, particularly those benefited by this process in transplanting.

Selection and Variety used:

<u>Selection.</u>	<u>Variety.</u>
Lettuce.	Black seeded forcing.
Cucumber.	Green Hybrid.
Cabbage.	Flat Dutch.
Kohl-Rabi.	-----
Cauliflower.	Earliest Dwarf Erfurt.
Tomato.	(Freedom. (Trophy.

Method of Investigation:

In this phase of the investigation, flats (18 x 14 in.) and six inch pots were used. Plants that had developed true leaves were selected, a certain number of which were

wilted, and a like number allowed to remain turgid prior to transplanting, great care being taken to select only thrifty, healthy plants with straight, stocky stems.

In each test plants were wilted until their leaves began to curl; the number of hours this required was recorded. After the leaves were wilted sufficiently, the plants were thoroughly watered and then allowed to regain their turgidity. The number of hours this required was also recorded. On regaining their turgidity, the plants were then transplanted into flats or pots. Then each series was given the same treatment until the end of the experiment.

Some very interesting data showing the comparative growth of wilted and turgid plants will be given in the following tables:

L e t t u c e I n v e s t i g a t i o n s .

T A B L E I.

Selection.....Lettuce.

Variety.....Black Seeded Forcing.

Flats were used. Weight in grams.

Test I.

	Date Planted	Hours Wilted	Hours Turgid	Transplanted	# Plants used	Final Wgt.	Top Wgt.	Wgt. Per. Plant.
* T	Dec 12.	—	—	Dec 23	50	Feb 23	49.612	.872
• W	Dec 12.	36	23	Dec 23	50	Feb 23	30.105	.602

Test II.

T	Jan 2	—	—	Feb 4	50	Mar 4	64.051	1.281
	Jan 2	—	—	Feb 4	50	Mar 4	68.520	1.370
W	Jan 2	48	26	Feb 4	50	Mar 4	40.101	.802
	Jan 2	36	24	Feb 4	50	Mar 4	31.131	.622

Test III.

T	Jan 6	—	—	Feb 12	50	Mar 12	61.080	1.221
	Jan 6	—	—	Feb 12	50	Mar 12	75.631	1.512
	Jan 6	—	—	Feb 12	50	Mar 12	81.451	1.629
W	Jan 6	28	24	Feb 12	50	Mar 12	36.500	.610
	Jan 6	36	26	Feb 12	50	Mar 12	24.561	.491
	Jan 6	36	26	Feb 12	50	Mar 12	36.492	.728

* Turgid
• Wilted

It will be seen from this table that in every instance the plants kept turgid prior to transplanting produced the heavier plants.

The average weight of the turgid plants was 1.314 grams per plant, while in the case of the wilted plants the average weight was .642 grams, making a difference of .672 grams in favor of the plants kept turgid prior to transplanting.

It goes without saying that, from the results obtained in this investigation, lettuce produces better plants when kept turgid prior to being transplanted.

C u c u m b e r I n v e s t i g a t i o n s .

T A B L E I I .

Selection.....Cucumber.

Variety.....Green Hybrid.

Flats were used.

Average distance between plants, 3 in. each way.

Final weight one month from day transplanted.

Test I.

	<i>wgt of seed.</i>	<i>Planted</i>	<i>Hrs Wilted</i>	<i>Hrs Turgid</i>	<i>Transplanted.</i>	<i>Plants Used</i>	<i>Final wgt.</i>	<i>Top Wgt.</i>	<i>Wgt. Per Plant.</i>
<i>Turgid</i>	<i>3.308</i>	<i>Jan 27</i>	<i>—</i>	<i>—</i>	<i>Feb 28</i>	<i>50</i>	<i>Mar 28</i>	<i>122.0</i>	<i>2.440</i>
<i>wilted</i>	<i>3.371</i>	<i>Jan 27</i>	<i>34</i>	<i>24</i>	<i>Feb 28</i>	<i>50</i>	<i>Mar 28</i>	<i>130.0</i>	<i>2.600</i>
Test II.									
<i>Turgid</i>	<i>3.201</i>	<i>Jan 30</i>	<i>—</i>	<i>—</i>	<i>Mar 1</i>	<i>80</i>	<i>Apr 1</i>	<i>171.50</i>	<i>2.143</i>
<i>wilted</i>	<i>3.120</i>	<i>Jan 30</i>	<i>30</i>	<i>24</i>	<i>Mar 1</i>	<i>82</i>	<i>Apr 1</i>	<i>168.52</i>	<i>2.640</i>
Test III.									
<i>Turgid</i>	<i>3.381</i>	<i>Feb 5</i>	<i>—</i>	<i>—</i>	<i>Mar 5</i>	<i>85</i>	<i>May 1</i>	<i>203.20</i>	<i>2.390</i>
	<i>3.140</i>	<i>Feb 5</i>	<i>—</i>	<i>—</i>	<i>Mar 5</i>	<i>40</i>	<i>May 1</i>	<i>127.00</i>	<i>3.100</i>
<i>wilted</i>	<i>3.176</i>	<i>Feb 5</i>	<i>30</i>	<i>24</i>	<i>Mar 5</i>	<i>40</i>	<i>May 4</i>	<i>142.00</i>	<i>3.550</i>
	<i>3.120</i>	<i>Feb 5</i>	<i>30</i>	<i>24</i>	<i>Mar 5</i>	<i>40</i>	<i>May 4</i>	<i>120.00</i>	<i>3.000</i>

Thus it is seen from the above data that plants that had been wilted prior to being transplanted weighed heavier than those that had been kept in a turgid condition, except in Test III. lot 2, when the turgid plants out-weighed the wilted plants 1 gram. The average weight per turgid plant was 2.518 grams, and the average weight per wilted plant was 2.947 grams, making a difference of .429 grams in favor of the latter.

C a b b a g e I n v e s t i g a t i o n s .

T A B L E I I I .

Selection.....Cabbage.

Variety.....Flat Dutch.

Average distance per plant, 3 inches.

Flats were used.

Final weight, one month from date transplanted.

Test I.

	wgt of Seed	Planted.	Hrs wilted	Hrs Turgid	Plants used	Transplanted	Final wgt.	Top Weight	wgt Per Plant.
Turgid	.282	Feb 16	—	—	20	Feb 26	Mar 26	28.00	1.40
	.280	Feb 16	—	—	20	Feb 26	Mar 26	21.00	1.05
	.400	Feb 16	—	—	20	Feb 26	Mar 26	26.00	1.30
wilted	.340	Feb 16	28	18	20	Feb 26	Mar 26	45.00	2.25
	.254	Feb 16	28	18	20	Feb 26	Mar 26	32.00	1.60
	.430	Feb 16	28	18	20	Feb 26	Mar 26	30.00	1.50

Test II.

Turgid	.278	Mar 1	—	—	20	Mar 12	Apr 12	27.00	1.35
	.430	Mar 1	—	—	20	Mar 12	Apr 12	41.00	2.05
wilted	.290	Mar 1	30	20	20	Mar 12	Apr 12	35.00	1.75
	.425	Mar 1	30	20	20	Mar 12	Apr 12	43.00	2.15

Test III.

Turgid	—	Mar 23	—	—	20	Mar 23	Apr 23	33.00	1.65
	—	Mar 23	—	—	20	Mar 23	Apr 23	35.00	1.75
wilted	—	Mar 23	32	20	20	Mar 23	Apr 23	31.00	1.55
	—	Mar 23	32	20	20	Mar 23	Apr 23	36.00	1.80

Test IV.

Turgid	—	Mar 23	—	—	20	Apr 1	May 1	20.00	1.00
	—	Mar 23	—	—	20	Apr 1	May 1	36.00	1.80
wilted	—	Mar 23	36	20	20	Apr 1	May 1	30.00	1.50
	—	Mar 23	36	20	20	Apr 1	May 1	37.00	1.85

It will be seen from this table that all tests except Test III., lot 1, favor wilting plants prior to transplanting.

It was also noted that the cabbage plants wilted prior to being transplanted did not grow to so great a height as did those that had been kept turgid, but they were more stocky.

The average weight per turgid plant was 1.422 grams, and the average weight per wilted plant was 1.772 grams, making a difference of .350 per plant in favor of the plants that were wilted prior to being transplanted.

Kohl-Rabi Investigations.

TABLE IV.

Selection.....Kohl-Rabi.
 Variety.....-----
 Flats were used.
 Weight in grams.

Test I.

	wgt of seed	Planted.	hrs wilted.	hrs Turgid	Plants Used.	Transplanted	Final wgt.	Top Wgt.	wgt per Plant.
Turgid.	360	Feb 16	—	—	25	Mar 8	Apr 8	65.00	2.60
	320	Feb 16	—	—	25	Mar 8	Apr 8	40.00	1.60
	392	Feb 16	—	—	25	Mar 8	Apr 8	100.00	4.00
	469	Feb 20	—	—	25	Mar 15	Apr 15	124.00	4.96
	501	Feb 20	—	—	25	Mar 15	Apr 15	130.00	5.20
Wilted.	364	Feb 16	24	18	25	Mar 8	Apr 8	36.00	1.44
	330	Feb 16	24	18	25	Mar 8	Apr 8	64.00	2.56
	400	Feb 16	26	22	25	Mar 8	Apr 8	120.00	5.20
	450	Feb 20	26	24	25	Mar 15	Apr 15	143.00	2.72
	461	Feb 20	28	24	25	Mar 15	Apr 15	164.00	6.56

Test II.

Turgid	—	Mar 12	—	12	10	Mar 28	Apr 28	30.00	3.00
	—	Mar 12	—	12	10	Mar 28	Apr 28	26.00	2.50
	—	Mar 12	—	12	10	Mar 28	Apr 28	22.00	2.20
Wilted	—	Mar 12	30	28	10	Mar 28	Apr 28	40.00	4.00
	—	Mar 12	30	28	10	Mar 28	Apr 28	34.00	3.40
	—	Mar 12	30	28	10	Mar 28	Apr 28	20.00	2.00

These data show that in Test I., lot 1, Test II., lot 3, there was a slight increase in weight per turgid plant. But in taking an average of weight per plant in both tests, it was found that the average weight per plant kept turgid prior to being transplanted was 3.257 grams, and the average weight per plant wilted prior to being transplanted was 3.460 grams, making a difference of .203 grams in favor of the latter.

Thus, in this experiment, Kohl-Rabi made the better plant when wilted prior to being transplanted.

Cauliflower Investigations.

TABLE V.

Selection.....Cauliflower.
 Variety.....Earliest Dwarf Erfurt.
 Flats were used (18 x 14 x 4 inches).
 Average distance planted, 3 in. each way.
 Final weight, one month from date transplanted.

Test I.

	Wgt. of seed	Date Planted	Hours wilted	Hours Turgid	# Plants Used	Transplanted	Final wgt.	Top wgt.	Wgt per plant.
Turgid	.130	Oct 22	—	—	25	Nov 10	Dec 10	20.01	.804
	.141	Oct 22	—	—	25	Nov 10	Dec 10	33.20	1.328
	.163	Oct 22	—	—	25	Nov 10	Dec 10	35.00	1.400
Wilted	.125	Oct 22	26	18	25	Nov 10	Dec 10	18.20	.728
	.134	Oct 22	26	18	25	Nov 10	Dec 10	34.03	1.361
	.171	Oct 22	26	18	25	Nov 10	Dec 10	40.00	1.600

Test II.

Turgid	.410	Nov 15	—	—	25	Nov 29	Dec 29	30.00	1.20
	.430	Nov 15	—	—	25	Nov 29	Dec 29	32.51	1.304
	.234	Nov 15	—	—	25	Nov 29	Dec 29	18.05	.722
	.416	Nov 15	—	—	25	Nov 29	Dec 29	29.32	1.172
Wilted	.400	Nov 15	30	24	25	Nov 29	Dec 29	42.67	1.706
	.424	Nov 15	30	24	25	Nov 29	Dec 29	40.01	1.604
	.237	Nov 15	30	24	25	Nov 29	Dec 29	31.06	1.242
	.115	Nov 15	30	24	25	Nov 29	Dec 29	20.36	.814

Test III.

Turgid	.164	Jan 15	—	—	25	Jan 29	Mar 1	40.11	1.604
	.260	Jan 15	—	—	25	Jan 29	Mar 1	29.02	1.120
	.401	Jan 15	—	—	25	Jan 29	Mar 1	34.71	1.388
	.346	Jan 15	—	—	25	Jan 29	Mar 1	43.52	1.740
	.282	Jan 15	—	—	25	Jan 29	Mar 1	31.62	1.264
Wilted	.480	Jan 15	65	30	25	Jan 29	Mar 1	44.30	1.771
	.181	Jan 15	65	30	25	Jan 29	Mar 1	18.75	.741
	.243	Jan 15	65	30	25	Jan 29	Mar 1	31.75	1.270
	.401	Jan 15	65	30	25	Jan 29	Mar 1	46.02	1.840
	.141	Jan 15	60	30	25	Jan 29	Mar 1	19.85	.794

Test IV.

	Wgt. of seed.	Date Planted	Hours Wilred	Hours Turgid	# Plants used.	Transplanted.	Final wgt.	Top wgt.	Wgt. Per Plant.
Turgid	—	Feb 1	—	—	25	Feb 19	Mar 19	41.30	1.652
	—	Feb 1	—	—	25	Feb 19	Mar 19	35.40	1.416
	—	Feb 1	—	—	25	Feb 19	Mar 19	16.25	.650
	—	Feb 1	—	—	25	Feb 19	Mar 19	20.81	.832
Wilted	—	Feb 1	60	30	25	Feb 19	Mar 19	36.51	1.460
	—	Feb 1	60	30	25	Feb 19	Mar 19	40.03	1.601
	—	Feb 1	60	30	25	Feb 19	Mar 19	18.02	.612
	—	Feb 1	60	30	25	Feb 19	Mar 19	21.85	.874

Test V.

Turgid	—	Mar. 12	—	—	10	Mar 26	Apr 26	26.00	2.000
	—	Mar. 12	—	—	10	Mar 26	Apr 26	10.00	1.000
	—	Mar. 12	—	—	10	Mar 26	Apr 26	27.00	2.701
	—	Mar. 12	—	—	10	Mar 26	Apr 26	27.00	2.701
Wilted	—	Mar 12	60	24	10	Mar 26	Apr 26	26.53	2.653
	—	Mar 12	60	24	10	Mar 26	Apr 26	30.01	3.001
	—	Mar 12	60	24	10	Mar 26	Apr 26	28.54	2.854
	—	Mar 12	60	24	10	Mar 26	Apr 26	28.54	2.854

Test VI.

Turgid	—	Mar 18	—	—	10	Apr 4	May 4	16.00	1.600
	—	Mar 18	—	—	10	Apr 4	May 4	25.00	2.500
	—	Mar 18	—	—	10	Apr 4	May 4	18.00	1.800
	—	Mar 18	—	—	10	Apr 4	May 4	18.00	1.800
Wilted	—	Mar 18	50	26	10	Apr 4	May 4	26.00	2.600
	—	Mar 18	50	26	10	Apr 4	May 4	32.56	3.256
	—	Mar 18	50	26	10	Apr 4	May 4	29.50	2.950
	—	Mar 18	50	26	10	Apr 4	May 4	29.50	2.950

From these data it will be observed that in Test I., lot 1, Test II., lot 4, Test III., lots 2, 3 and 5, Test IV., lots 1 and 3, the plants that had been kept turgid prior to being transplanted weighed heavier than those that had been wilted.

It will also be seen that in the remaining series of the tests that the plants that had been wilted prior to being transplanted weighed heavier than the turgid plants.

The average weight per turgid plant was 1.4175 grams, as compared with 1.6964 grams for wilted plant, making a difference of .2789 grams in favor of the latter.

Therefore, from these data, Cauliflower plants produce better growth when wilted previous to being transplanted.

Tomato Investigations.

TABLE VI.

Selection.....Tomato.

Variety.....Freedom.

Plants transplanted average distance 4 inches in flats.

Pots and flats were used in various tests.

Test I. - Pots used.

	wgt of seed.	Planted	Wts wilted	Wts Turgid	Transplanted	Plants used	Final wgt	Top wgt	wgt per plant.
Lot 1. Turgid	—	Oct 1	—	—	Oct 19	25	Nov 19	190	7.60
Lot 1. Wilted	—	Oct 1	40	22	Oct 19	25	Nov 19	210	8.40
Lot 2 Turgid	—	Oct 5	—	—	Oct 20	25	Nov 20	218.	8.72
Wilted	—	Oct 5	42	20	.. 20	25	Nov 20	230.	9.20
Lot 3 Turgid		Oct 10	—	—	Oct 29	25	Nov 29	220.	8.80
Wilted		Oct 10	40	20	Oct 29	25	Nov 29	241.	9.64

In this test it will be seen that the plants were weighed one month from the date they were transplanted, and in every instance the weight was greater wherever the plants had been wilted previous to being transplanted.

A summary of the test is as follows:

	<u>Per plant.</u>
Average height of turgid plants.....	5.5 in.
Average height of wilted plants.....	4.0 "
Average diameter of turgid plants.....	1/8 "
Average diameter of wilted plants.....	1/4 "
Average weight of turgid plants.....	8.373 grams.
Average weight of wilted plants.....	9.080 "

Thus, there was a difference of .707 grams in favor of the plants wilted prior to being transplanted.

Test II.

The plants used in this test were transplanted into flats. All plants used were of an average size, and had formed their true leaves, the average height of plants being approximately 2.5 inches. The plants were allowed to wilt until the leaves began to curl, as was previously mentioned, and then watered and allowed to become turgid again before being transplanted.

The following table shows the results of Test II.

Variety.....Freedom.

Test II.

	Wgt of seed	Planted	Hrs Wilted	Hrs Turgid	Transplanted	#Plants Used	Date Final Wgt	Top Wgt.	Wgt. Per Plant
Lot II	—	Oct 1	—	—	Oct 18	25	Dec 18	452.12	18.08
Turgid	—	Oct 1	40	22	Oct 18	25	Dec 18	735.01	29.40
Wilted	—								

Lot II	—	Oct 10	—	—	Oct 29	25	Dec 29	1020.00	40.8
Turgid	—	Oct 10	48	24	Oct 29	25	Dec 29	1210.00	48.4
Wilted	—								

The plants used in this test were set every six inches in rows six inches apart.

The average height of the plants that had been kept turgid was 20.1 inches, making an average growth in height of 17.6 inches per plant within two months from the date of transplanting.

The average growth in height of the plants that had been wilted before transplanting, and that had received the same treatment after being transplanted as had the turgid plants, was only 14.5 inches, making an average growth in height of 12. inches in the two months, thus making a difference of 3.1 inches between the turgid and the wilted plants. This was not a favorable result for the turgid plant, as we want plants that are stocky for fruiting purposes.

The average weight of the plants kept turgid prior to transplanting was 29.44 grams, as compared with 38.99 grams for wilted plants, making a difference of 9.55 grams per plant in favor of the latter.

The average diameter of the turgid plant was $\frac{1}{4}$ inch, and that of the wilted plants $\frac{1}{2}$ inch, making a difference of $\frac{1}{4}$ inch in favor of the wilted plant.

Thus, it will be seen from this table, that the tomato plants wilted prior to being transplanted made the better plants.

T A B L E V I.

Test III.

Selection.....Tomato.

Variety.....Trophy.

Lot I. Planted in 6 in. pots; transplanted into six inch pots.

Lot.2. Flats were used. Average distance of plants, 10 inches each way.

	Wgt of seed	Planted	hrs. wilted	hrs. turgid	Plants used	Transplanted		Final wgt.	Top weight	Wgt per plant.
Lot I Turgid	—	Nov 26	—	—	6	Dec 19	Jan 19	Feb 19	270.	45.0
	—	Nov 26	—	—	6	19	1	Feb 19	221.	36.8
	—	Nov 26	—	—	6	19	1	Feb 19	254.	42.3
Wilted	—	Nov 26	60	24	6	19	1	Feb 19	264.	44.0
	—	Nov 26	60	24	6	19	1	Feb 19	271.	45.1
	—	Nov 26	60	24	6	19	1	Feb 19	280	46.6
Lot II Turgid	—	Nov 26	—	—	6	19	1	Feb 19	200.	33.3
	—	Nov 26	—	—	6	19	1	Feb 19	190.	30.0
	—	Nov 26	—	—	6	19	1	Feb 19	190.	30.0
Wilted	—	Nov 26	64	30	6	19	1	Feb 19	210.	35.0
	—	Nov 26	64	30	6	19	1	Feb 19	191.	31.8
	—	Nov 26	64	30	6	19	1	Feb 19	191.	31.8

It will be seen from these tests that all plants in lots 1 and 2 were transplanted twice during the investigation.

The second wilting of the plants required 55 hours, and 30 hours to regain their turgidity.

The plants that had been kept turgid prior to being transplanted in lot 1, series 1, weighed 1. gram heavier than the plants that had been wilted prior to being transplanted. With this exception, the wilted plants weighed heavier throughout the investigation.

The following table gives further data on these tests:

	Lots	Our Height Growth	Our Diameter Per Plant	First Bloom	Fruit Formed	* Fruit Per Plant	Wgt of Fruit	Wgt. Per Fruit
Turgid	I, II	22"	$\frac{1}{2}$ "	Feb 2	Feb 12	3	241.52	2.68
Wilted	I, II	17"	$\frac{3}{4}$ "	Feb 4	Feb 15	4	361.05	4.01

It will be observed, from this table, that the amount of growth in height was 5 inches in favor of the turgid plant, but growth in height is not desired for fruiting purposes.

The difference in diameter was $\frac{1}{4}$ inch in favor of the plant that had been wilted.

The plant that had been kept turgid formed fruit three days earlier than the plants wilted, but the wilted plant produced more and heavier fruit per plant, the difference

in weight of fruit being 1.33 grams, and in plant weight, 3.02 grams per plant, in favor of the plants that had been wilted previous to being transplanted.

Thus, from these tables, tomatoes made better plants when wilted previous to being transplanted.

T A B L E V I.

Test IV.

Variety..... Trophy.

Number seed planted...150.

Lot 1 planted in 6 inch pots.

Lots 2 and 3 planted in flats.

	wgt of seed	Planted	hrs Wilted	hrs Turgid	Transplanted			# Plants	Final wgt	Top wgt	Wgt per Plant
Lot I. Turgid	431	Jan 2	—	—	Jan	Feb		6	May 1	201.	33.5
	440	Jan 2	—	—	18	8		6	May 1	210.	35.0
	431	Jan 2	60	28	18	8		6	May 1	221	36.8
	440	Jan 2	60	28	18	8		6	May 1	228	38.0
Lot II Turgid	431	Jan 2	—	—	18	8		6	May 4	216	36.0
	440	Jan 2	—	—	18	8		6	May 4	200	33.3
	431	Jan 2	60	28	18	8		6	May 4	218.	36.3
	440	Jan 2	60	28	18	8		6	May 4	198.	33.0
Lot III Turgid	431	Jan 2	—	—	Jan	Feb	Mar	6	May 6	223	37.1
	440	Jan 2	—	—	18	28	6	6	May 6	230.	38.3
	431	Jan 2	60	28	18	28	6	6	May 6	237.	39.5
	440	Jan 2	60	28	18.	28	6	6	May 6	250	41.6

Table showing comparison of lots 1, 2 and 3 in reference to growth and fruitfulness.

T A B L E V I.

Test IV.

	Lot S	Avg Height of Plant	Avg Diameter Per Plant	First Bloom	First Fruit Formed	Total # Tomatoes	# Tomatoes Per Plant	Total Wgt Fruit	Wgt. per Fruit
Turgid	1	21"	4.25	Feb 20	Mar 1	24	2	120.	5.
	2	19"	3.5	Feb 18	Mar 3	37	3.5	206.1	5.5
	3	16"	2.5	Feb 18	Mar 7	61	5.5	518.0	8.4
Wilted	1	17"	2.5	Feb 16	Mar 3	48	4	261.0	5.4
	2	16"	2.5	Feb 18	Mar 7	49	4	322.8	5.6
	3	12"	.5	Feb 22	Mar 11	74	6	800.7	10.8

It will be seen from this table that the plants in lot 1 that had been wilted prior to being transplanted outweighed the plants in lots 1 and 2.

The average weight of plants that had been kept turgid was 35.53 grams.

The average weight of plants that had been wilted was 37.5 grams, making a difference of 2. grams per plant in favor of the plants wilted prior to being transplanted.

All plants used in this investigation were transplanted twice, and lot 3 was transplanted a third time.

The plants that had been kept turgid throughout the experiment made greater growth in height than those wilted

prior to being transplanted.

Plants that had been wilted were from two to five days later in blooming, but the plants produced more fruit and the fruit weighed heavier than that produced from plants kept turgid. The difference in weight was 3.9 grams in favor of the plants wilted prior to being transplanted.

R O O T G R O W T H.

In determination of this phase of the investigation, two lines of experiments, aside from the transplanting of plants into soil, were used.

Seedlings, wilted previous to transplanting, were carefully examined and their root system measured. The plants were then put to grow in a thoroughly moist atmosphere, under a bell glass. This was done in order to follow the restorative effect, that is, to see where the new roots developed, whether the tips of old roots survived, etc.

Plants ordinarily wilted in transplanting were transplanted in a turgid and flaccid condition alongside, and some subjected on the one hand to saturated atmospheric conditions, and others to drier conditions.

Each bell glass, average height, 14 in., was lined with filter paper and placed on plates covered with several layers of the same material. On the plates were placed small glass bowls containing coarse sand; over the sand was placed a layer of filter paper, this being done to keep the roots thoroughly moist, also to keep them free from sand particles.

Plants used were:

Lettuce;

Cabbage;

Kohl-Rabi;

Cauliflower;

Cucumber;

Tomato.

All plants were placed under the same conditions prior to being transplanted, as were the plants that had been transplanted into flats and pots. A certain number were wilted, and a like number kept turgid. As has already been stated, these plants were thoroughly examined and their root system measured before they were subjected to the bell glass. Each day both wilted and turgid plants were examined, in order to see what had happened to their root system, whether the old roots continued to grow, or whether new side roots had formed.

As a result of these experiments, the following summary will be given:

Lettuce:

The old root system of the plants kept turgid prior to transplanting continued to grow. No new lateral roots were formed above the old root system.

The roots of the plants that had been wilted prior to transplanting did not survive, but died before the formation of new roots began.

Cabbage:

The old root system of both turgid and wilted plants prior to transplanting, when placed under bell jars, did not survive, but new lateral roots were formed. The average growth of new roots, 1.3 c.m. in six days, was practically the same for both plants. But at the end of the ninth day the root system of the plants wilted prior to transplanting had gained .2 c.m. over that of the plants that had been kept turgid previous to transplanting.

Kohl-Rabi:

The old root system in both turgid and wilted plants withered and died. New roots formed above the old root system, and at the end of one week the roots produced upon plants wilted prior to transplanting averaged .7 c. m. growth, and the roots on the turgid plants measured 2.7 c.m., making a difference of 2.0 c.m. in favor of the wilted plants.

Cauliflower:

The tips of the old root system did not survive, but instead new roots developed above the old root system, and the growth of new roots was much faster than in the case of Cabbage and Kohl-Rabi. The average growth of turgid plant roots was 2. c.m., and the average of wilted plant roots was 3. c.m., making a difference of 1.0 c.m. in favor of the wilted plant.

Cucumber:

The wilted plants produced new lateral roots above the old root system, which did not survive. Average length of roots produced upon the turgid plant was 1. 5 c.m., and the average length of roots produced upon the wilted plant was 2. 2 c.m., making a difference of .7 c.m. in favor of the plants wilted previous to being transplanted.

Tomato:

The root growth of turgid and wilted tomato plants was studied, and it was found that, as in the case of Cabbage, Kohl-Rabi, Cauliflower and Cucumber, the old roots did not survive, but instead, new lateral roots were produced above the old root system.

The Tomato produced more and healthier looking roots than the other vegetables used in the investigation. The average length growth of roots produced upon the turgid plant in six days was 5. 1 c.m., and the average length growth of roots produced upon the wilted plant was 8. c.m., making a difference of 3. c.m. in favor of the plants wilted prior to being transplanted.

S U M M A R Y.

Comparative Growth of Wilted and Turgid Plants.

Lettuce produced better plants when kept turgid prior to transplanting.

Cucumber produced better plants when wilted prior to transplanting. The difference was not so marked as in the case of lettuce.

Cabbage, Kohl-Rabi and Cauliflower produced better plants when wilted prior to transplanting.

Tomato produced better plants when wilted prior to transplanting. The Tomato showed a greater difference in favor of wilting plants prior to transplanting than did any of the other plants studied in the investigation.

CORN INVESTIGATION.

Comparative Weight: Germinating Power of Seeds From Different Parts of the Plant.

This experiment was undertaken for the purpose of determining the comparative weight and germinating power of seeds selected from different parts of the plant. Corn was the only available seed at the time the experiment was decided upon.

Selection.

The ears of corn that had been selected were as nearly cylindrical as possible, strong, and well developed, with straight rows of medium sized kernels.

The kernels were uniform in size, shape, color and indentation. The tips were clean, and the germs were full, smooth and bright.

Each ear of corn that had been selected was divided into sections, as follows:

The tip; the second fourth; the third fourth; and the butt.

From each section fifteen or more kernels were selected and their weights recorded.

Methods used:

The seed that had been selected from the different sections were first weighed and then planted in six inch pots containing either common gardeners' soil or coarse sand (washed), according to the decision of the writer. The soil test was to show just what the growth would be under ordinary conditions, while the sand test would show what the growth would be when the food supply of the plant was restricted mainly to the kernel.

The grains were placed one every inch, with the tip end down. The depth of planting was one inch, plus a layer of coarse sand. The corn was then allowed to grow for one month, at the end of which time the tops of the plants from each of the four sections were weighed and measured in reference to growth in height and width. The root weight of the plants was not recorded, as it was almost impossible to remove all soil particles without more or less injury to the root system.

Varieties of Corn used:

Boone County White;

Leaming;

Silvermine;

Reid's Yellow Dent.

The following tables will give the results of the Corn investigations.

T A B L E I.

Variety.....Boone County White.

Number seed used...Fifteen or more.

Six inch pots were used.

Weights in grams.

Test I.

Section of Ear.	Wgt of seed	Planted	First seed up	#Nernels Germinated	Avg. height of plant from ground to tip of leaf.	Diameter of plant stalk.	avg width of leaf.	Final Wgt	Top wgt	Avg wgt per plant.
Tip	5.17	Jan 9	Jan 15	14	10"	0.125"	0.500"	Feb 9	23	1.65
	4.57	Jan 9	Jan 15	14	12	0.125"	0.500"	Feb 9	28	2.00
	5.13	Feb 9	Feb 14	14	10"	0.250"	0.500"	Mar 9	28	2.00
	4.21	Feb 9	Feb 14	14	8"	0.250"	0.500"	Mar 9	22	1.57
	4.29	Feb 9	Feb 14	15	11"	0.125"	0.500"	Mar 9	26	1.73
	5.20	Feb 9	Feb 14	15	9"	0.125"	0.500"	Mar 9	30	2.00
	* 14.60	Apr 1	Apr 9	37	7"	0.125"	0.750"	May 1	40	1.08
3 from 4 Butt	4.64	Jan 9	Jan 15	14	9"	0.25"	0.500"	Feb 9	20	1.42
	5.57	Jan 9	Jan 15	14	11"	0.25	0.750	Feb 9	26	1.85
	4.50	Feb 9	Feb 14	14	8"	0.25	0.750"	Mar 9	26	1.85
	5.54	Feb 9	Feb 14	15	12"	0.50	0.750"	Mar 9	25	1.66
	5.61	Feb 9	Feb 14	15	10"	0.50	0.500"	Mar 9	31	2.06
	5.56	Feb 9	Feb 14	15	9"	0.25	0.750"	Mar 9	24	1.60
	* 15.00	Apr 1	Apr 11	36	6"	0.25	0.500"	May 1	49	1.36
2 from 4 Butt	5.15	Jan 9	Jan 15	13	10"	0.25	0.750"	Feb 9	24	1.84
	5.65	Jan 9	Jan 15	14	12"	0.25	1.000"	Feb 9	28	2.00
	5.00	Feb 9	Feb 14	13	14"	0.25	0.750	Mar 9	27	1.92
	5.25	Feb 9	Feb 14	12	12"	0.25	1.000	Mar 9	24	2.00
	5.34	Feb 9	Feb 14	10	11"	0.25	1.000	Mar 9	38	3.45
	5.42	Feb 9	Feb 14	13	13"	0.25	0.750	Mar 9	27	2.07
	* 15.56	Apr 1	Apr 11	44	7"	0.25	0.750	May 1	65	1.50
Butt	6.17	Jan 9	Jan 16	14	9"	0.25	1.00"	Feb 9	38	2.71
	6.30	Jan 9	Jan 16	12	12"	0.25	1.00"	Feb 9	23	1.91
	6.20	Feb 9	Feb 17	12	10"	0.25	1.00	Mar 9	23	1.91
	6.17	Feb 9	Feb 17	14	9.5"	0.25	0.75	Mar 9	22	1.57
	6.19	Feb 9	Feb 17	14	11.5"	0.50	0.75	Mar 9	27	1.92
	6.32	Feb 9	Feb 17	12	12.0	0.50	1.00	Mar 9	25	2.83
	* 16.44	Apr 1	Apr 11	44	5.0	0.25	1.00	May 1	67	1.52

From the above table will be seen the results of the comparative weights and germinating power of seeds grown in soil and of those grown in coarse sand (washed).

These seed were selected from four different ears of corn. 90 seed were planted in soil, and 45 were planted in sand.

Summarizing the results of the above table, we have the following comparisons:

Section: Tip.

Number seed germinated.....86
Average height per plant.....10 inches
Average width per leaf..... 0.5 "
Average diameter per plant.....0.166+ "
Average weight per plant..... 1.825 grams.

Section: Three-fourths from butt.

Number seed germinated.....87
Average height per plant..... 9+ inches.
Average width per plant..... 0.666+ inches.
Average diameter per plant..... 0.333+ "
Average weight per plant..... 1.74 grams.

Section: Two-fourths from butt.

Number seed germinated.....75
Average height per plant.....12 inches
Average width per leaf..... 0.916+ "
Average diameter per plant..... 0.25 "
Average weight per plant..... 2.211 grams.

Section: Butt.

Number seed germinated.....78

Average height per plant.....10+ inches

Average width per leaf..... 0.916 "

Average diameter per plant... .0416+"

Average weight per plant..... 2.141 grams.

The greatest number of plants was produced from the kernels selected three-fourths from the butt end, and the fewest plants, two-fourths from the butt.

While the tip grains produced just one plant less than the third fourth, the plants had ceased growing in height and their outside leaves had turned yellow several days before the final weights were recorded. The plants from the remaining three sections were growing and all leaves in good condition at the end of the experiment.

This goes to show that in the case of the tip kernels the food supply was about exhausted.

The greatest growth in height and width, also the heaviest plants, were produced from the kernels that had been selected two-fourths from the butt.

T A B L E I I.

Variety.....Leaming.

Number seed used.....Fifteen or more.

Six inch pots were used.

Weight in grams.

Test I.

Section of Ear.	Wgt of seed	Planted	First Seedling	#Kernels Germinated	Avr height of Plant from Ground to top of Leaf	Diameter of Plant stalk	Average width of Leaf	Final wgt.	Top Wgt	Avr Wgt per plant.
Tip	4.75	Feb 14	Feb 20	15	16"	0.125	0.50	Mar 15	48	3.200
	4.80	Feb 14	Feb 20	15	12"	0.125	0.50	Mar 15	32	2.183
	4.87	Feb 14	Feb 20	15	13"	0.125	0.50	Mar 15	33	2.200
	4.258	Feb 15	Feb 21	15	14"	0.125	0.50	Mar 15	43	2.866
	4.300	Feb 15	Feb 21	14	14"	0.125	0.50	Mar 15	52	3.714
	4.335	Feb 15	Feb 21	15	14"	0.125	0.50	Mar 15	42	2.800
	* 15.97	Apr 6	Apr 12	39	5"	0.250	0.75	May 6	25	.6410
$\frac{3}{4}$ from Butt	5.319	Feb 14	Feb 23	15	15"	0.125	0.50	Mar 15	51	3.400
	5.523	Feb 14	Feb 20	15	18"	0.125	0.50	Mar 15	50	3.333
	5.368	Feb 14	Feb 23	12	15"	0.125	0.50	Mar 15	52	4.333
	4.284	Feb 15	Feb 23	15	12"	0.125	0.50	Mar 15	38	2.533
	4.499	Feb 15	Feb 23	14	13"	0.125	0.50	Mar 15	34	2.428
	4.534	Feb 15	Feb 23	15	14"	0.125	0.50	Mar 15	40	2.666
	* 16.10	Apr 6	Apr 14	37	7"	0.250	1.00	May 6	40	1.0810
$\frac{2}{4}$ from Butt	6.045	Feb 14	Feb 21	14	17"	0.250	1.00	Mar 15	62	4.488
	6.012	Feb 14	Feb 21	15	14"	0.250	1.00	Mar 15	40	2.666
	6.199	Feb 14	Feb 21	14	17"	0.250	1.00	Mar 15	64	4.571
	4.720	Feb 15	Feb 21	12	11"	0.250	1.00	Mar 15	31	2.583
	4.825	Feb 15	Feb 21	11	15"	0.250	1.00	Mar 15	33	3.000
	4.979	Feb 15	Feb 21	11	15"	0.250	1.00	Mar 15	32	2.909
	* 17.25	Apr 6	Apr 14	36	4"	0.250	0.750	May 6	25	.6944
Butt.	6.543	Feb 14	Feb 21	13	15"	0.125	1.00	Mar 15	38	2.923
	6.919	Feb 14	Feb 21	15	14"	0.125	1.00	Mar 15	39	2.533
	7.079	Feb 14	Feb 21	14	14"	0.125	1.00	Mar 15	34	2.428
	4.362	Feb 25	Feb 21	12	15"	0.125	1.00	Mar 15	36	3.000
	5.446	Feb 25	Feb 21	15	16"	0.125	1.00	Mar 15	50	3.333
	5.496	Feb 25	Feb 21	10	15"	0.125	1.00	Mar 15	36	3.600
	* 18.15	Apr 6	Apr 14	37	4"	0.125	1.00	May 6	27	.7297

Thus, it will be seen from the above data that 90 kernels were planted in soil, and 45 in coarse sand (washed). The seed were selected from four different ears of corn.

The following is a comparison of results of the experiment with Leaming Corn.

Section: Tip.

Number seed germinated.....89.
Average height per plant.....13+ inches.
Average width per leaf..... 0.5 "
Average diameter per plant..... 0.125 "
Average weight per plant..... 2.818+grams.

Section: Three-fourths from butt.

Number seed germinated.....86.
Average height per plant.....14+ inches.
Average width per leaf..... 0.5 "
Average diameter per plant..... 0.125 "
Average weight per plant..... 3.115 grams.

Section: Two-fourths from butt.

Number seed germinated.....77.
Average height per plant.....14+ inches.
Average width per leaf..... 1.00 "
Average diameter per plant..... 0.25 "
Average weight per plant..... 3.3595 grams.

Section: Butt.

Number seed germinated.....79.
Average height per plant.....14+ inches.
Average width per leaf..... 1.00 "
Average diameter per plant..... .125 "
Average weight per plant.....2.969 grams.

In this experiment 90 kernels were planted in soil and 45 kernels were planted in sand. The tip kernels in both tests germinated first, and these produced the greatest number of plants. But the plants produced weighed lighter in both tests than did the plants produced from the remaining three sections. The average growth in height of the tip plants was one inch less in the soil test than in the other sections. But in the sand test the average height of plants produced from the tip kernels was 5 inches, this being 2 inches less than the average height of the third fourth, and one inch greater than those grown from kernels selected from the second fourth and the butt sections.

As was the case in Table I., the plants produced from the tip kernels ceased growing and their outer leaves had turned yellow, while the plants in the three remaining sections continued growing, up to the close of the experiment, and the outer leaves of these plants were still green and in a perfectly healthy condition.

The average diameter of the plants grown from the tip, the second fourth and the butt sections in the soil test was .125 of an inch greater per plant than the plants grown from the third fourth. In the sand test the average diameter per plant was practically the same for all sections.

In the soil test the average width per leaf was .5 of an inch for the tip and the same for the third fourth, and a difference 1 inch for the second fourth and butt sections, making_^ of .5 of an inch in favor of the latter.

In the soil test the heavier plants were produced from kernels selected three fourths from the butt, while in the sand test the heavier plants were produced from kernels selected two fourths from the butt. The lightest weight plants, as has been previously stated, were produced from the tip kernels.

T A B L E I I I.

Variety.....Silvermine.

Number seed used.....Fifteen or more.

Six inch pots were used.

Weight in grams.

Test I.

Section of Ear.	Wgt of Seed	Planted	First seed up	Kernels Germinated	Avr height of plant from Ground to leaf tip	Diameter of plant stalk	Avr width of leaf	Final wgt	Top wgt	Avr wgt per Plant.
Tip	4.365	Jan 8	Jan 15	13	13"	0.125"	0.50"	Feb 8	36	2.769
	3.728	Mar 20	Mar 24	15	11"	0.125"	0.50"	Feb 20	24	2.111
	3.730	Mar 20	Mar 24	15	13"	0.125"	0.50"	Feb 20	30	2.307
	4.018	Mar 20	Mar 24	11	12"	0.125"	0.50"	Feb 20	27	2.454
	4.050	Mar 20	Mar 24	15	12"	0.125"	0.50"	Feb 20	29	1.934
	4.219	Mar 20	Mar 24	14	15"	0.125"	0.50"	Feb 20	52	3.714
	4.470	Mar 20	Mar 24	9	9"	0.125"	0.50"	Feb 20	20	2.222
	4.570	Apr 6	Apr 10	11	13"	0.125"	0.50"	May 6	22	2.000
	4.419	Apr 6	Apr 10	14	11"	0.125"	0.50"	May 6	27	2.454
3 from 4 Butt	5.655	Jan 8	Jan 16	10	9"	0.250	0.75"	Feb 8	23	2.300
	4.288	Mar 20	Mar 25	15	13"	0.250	0.75"	Apr 20	35	2.833
	4.239	Mar 20	Mar 25	15	14"	0.250	0.75"	Apr 20	58	3.866
	4.245	Mar 20	Mar 25	15	14"	0.250	0.75"	Apr 20	60	4.000
	4.315	Mar 20	Mar 25	15	13"	0.250	0.75"	Apr 20	61	4.066
	4.530	Mar 20	Mar 25	15	14"	0.250	0.75"	Apr 20	46	3.066
	4.535	Mar 20	Mar 25	15	14"	0.250	0.75"	Apr 20	60	4.000
	4.488	Apr 6	Apr 10	15	13"	0.250	0.75"	May 6	46	3.066
	4.420	Apr 6	Apr 10	15	14"	0.250	0.75"	May 6	50	3.333
2/4 from Butt	5.475	Jan 8	Jan 16	14	14"	0.250	1.00"	Feb 8	24	1.714
	4.570	Mar 20	Mar 25	15	12"	0.250	1.00"	Apr 20	45	3.000
	4.823	Mar 20	Mar 25	15	13"	0.250	1.00"	Apr 20	77	5.133
	4.829	Mar 20	Mar 25	15	14"	0.250	1.00"	Apr 20	47	3.133
	4.830	Mar 20	Mar 25	14	19"	0.250	1.00"	Apr 20	60	4.285
	4.840	Mar 20	Mar 25	15	13"	0.250	1.00"	Apr 20	42	2.800
	4.913	Mar 20	Mar 25	15	16"	0.250	1.00"	Apr 20	40	2.666
	4.640	Apr 6	Apr 11	18	14	0.333	1.00"	May 6	53	3.533
	4.712	Apr 6	Apr 11	18	17	0.333	1.00"	May 6	54	3.600
Butt	6.69	Jan 8	Jan 16	13	9"	0.250	1.00	Feb 8	30	2.307
	4.820	Mar 20	Mar 25	12	12"	0.250	1.00	Apr 20	39	3.250
	4.823	Mar 20	Mar 25	15	13"	0.333	.75	Apr 20	57	3.800
	5.303	Mar 20	Mar 25	13	14"	0.333	0.75	Apr 20	40	3.769
	5.333	Mar 20	Mar 25	15	12"	0.333	0.75	Apr 20	75	5.000
	5.550	Mar 20	Mar 25	15	11"	0.333	0.75	Apr 20	40	2.666
	5.554	Mar 20	Mar 25	15	12"	0.333	0.75	Apr 20	44	2.933
	5.630	Apr 26	Apr 11	14	14"	0.333	0.75	May 6	70	5.000
	6.712	Apr 26	Apr 11	15	12"	0.333	0.75	May 6	62	4.133

Table III.

Silvermine.

Comparisons Table III.

Section: Tip.

Number seed germinated.....	117
Average height per plant.....	12+ inches.
Average width per leaf.....	0.5 "
Average diameter per plant.....	0.125 "
Average weight per plant.....	2.440 grams.

Section: Three-fourths from butt.

Number seed germinated.....	130
Average height per plant.....	13+ inches.
Average width per leaf.....	.75 "
Average diameter per plant.....	.25 "
Average weight per plant.....	3.336+grams.

Section: Two-fourths from butt.

Number seed germinated.....	133
Average height per plant.....	13+ inches
Average width per leaf.....	1. "
Average diameter per plant.....	.25 "
Average weight per plant.....	3.296 grams.

Section: Butt.

Number seed germinated.....	127
Average height per plant.....	12+ inches.
Average width per leaf.....	1.0 "
Average diameter per plant.....	.25 "
Average weight per plant.....	3.650 grams.

This table does not include data on the sand test, due to the fact that the seed planted in the sand failed to germinate. The reason for this is unknown, as the conditions were practically the same in all tests. The seed used in the soil test were selected from four different ears of corn, and 135 seed were planted.

From the above data it will be observed that the tip kernels were first to germinate, except in the tests planted on April 6th. In these tests the seed from both the tip and the third fourth section germinated on the same day.

The tip kernels produced a fewer number of plants, and the average diameter of the plants produced was .125 of an inch per plant less than the diameter of plants grown from the remaining three sections.

The average growth in height was 12 inches per plant for the tip and butt sections, and 13 inches per plant for the third fourth and second fourth sections, making a difference of 1 inch in favor of the plants grown from the latter.

The plants grown from the butt kernels averaged heaviest in this experiment. The weight of these was 3.650 grams per plant, while the plants grown from the tip kernels averaged 2.440 grams per plant, making a difference of 1.210 grams in favor of the former. The difference in weight per plant of the third fourth and second fourth sections was very slight, not more than .040 grams per plant, in favor of the latter.

In this experiment the tip plants ceased growing in height two days before the close of the experiment. But these plants were perfectly healthy in appearance, and their outer leaves showed no signs of turning yellow.

T A B L E I V.

Variety.....Reid's Yellow Dent.

Number seed used.....Fifteen or more.

Six inch pots were used.

Weight in grams.

Test I.

Section of Ear.	Wgt of seed	Planted	First seed up	Kernels Germinated	Av height of plant from Ground to tip of leaf.	Diameter of plant stalk	Av width of leaf.	Final wgt.	Top wgt.	Av wgt Per plant.
Tip	3.479	Mar 20	Mar 24	15	20"	0.25"	0.25"	Apr 24	80	5.333
	3.490	Mar 20	Mar 24	15	16"	0.25"	0.75"	Apr 24	50	3.333
	4.429	Mar 20	Mar 24	14	24"	0.25"	0.75"	Apr 24	82	5.867
	4.465	Mar 20	Mar 24	15	25"	0.25"	0.75"	Apr 24	82	5.466
	* 14.00	Apr 9	Apr 17	42	4"	0.25"	0.25"	May 9	15	3.571
$\frac{3}{4}$ from Butt.	4.380	Mar 20	Mar 24	15	20"	0.25"	1.00"	Apr 24	112	7.466
	4.420	Mar 20	Mar 24	15	23"	0.25"	1.00"	Apr 24	100	6.666
	4.900	Mar 20	Mar 24	15	23"	0.25"	1.00"	Apr 24	95	6.333
	5.050	Mar 20	Mar 24	15	21"	0.25"	1.00"	Apr 24	89	5.933
	* 15.85	Apr 9	Apr 17	37	4.5"	0.25"	1.00"	May 9	25	6.756
$\frac{2}{4}$ from Butt	4.479	Mar 20	Mar 25	15	18"	0.333"	1.00"	Apr 24	59	3.813
	4.472	Mar 20	Mar 25	15	18"	0.333"	1.00"	Apr 24	60	4.000
	5.238	Mar 20	Mar 25	15	16"	0.250"	1.00"	Apr 24	40	2.666
	5.284	Mar 20	Mar 25	15	15"	0.250"	1.00"	Apr 24	48	3.200
	* 17.25	Apr 9	Apr 17	36	4"	0.25"	1.00"	May 9	25	6.944
Butt	5.100	Mar 20	Mar 25	14	15"	0.250"	0.750	Apr 24	49	3.500
	5.157	Mar 20	Mar 25	15	15"	0.250"	0.750	Apr 24	62	4.133
	6.000	Mar 20	Mar 25	15	18"	0.250"	0.750	Apr 24	60	4.000
	6.360	Mar 20	Mar 25	15	17"	0.250"	0.750	Apr 24	45	3.000
	* 18.87	Apr 9	Apr 17	30	3"	0.250"	1.00"	May 9	20	

* Sand Test.

Table IV.

Comparisons Table IV.

Reid's Yellow Dent.

Section: Tip.

Number seed germinated.....59
 Average height per plant.....21+ inches.
 Average width per leaf..... 0.625 "
 Average diameter per plant..... 0.25 "
 Average weight per plant..... 4.997+ grams.

Section: Three-fourths from butt.

Number seed germinated.....60
 Average height per plant.....21+ inches.
 Average width per leaf..... 1.0 "
 Average diameter per plant..... 0.25 "
 Average weight per plant..... 6.599+grams

Section: Two-fourths from butt.

Number seed germinated..... 60
 Average height per plant..... 16+ inches
 Average width per leaf..... 1.0 "
 Average diameter per plant..... 0.2915"
 Average weight per plant..... 3.419+ grams.

Section: Butt.

Number seed germinated.....59
 Average height per plant.....16+ inches.
 Average width per leaf..... 0.75 "
 Average diameter per plant..... 0.25 "
 Average weight per plant..... 2.908 grams.

From these data, it will be seen that in the soil tests the first seeds to germinate were those that had been selected from the tip, also those selected three fourths from the butt end. In the sand test a few seed from each of the four sections germinated on the same day.

In the soil test the kernels of the third fourth and those of the second fourth from the butt end produced the greatest number of plants, while in the sand test the tip kernels averaged the greatest number of plants.

In the soil test the average growth in height of plants grown from kernels selected from the tip and the third fourth sections was 21 inches per plant, and the average height of those grown from the second fourth and butt sections was 16 inches per plant, making a difference of 5 inches, in favor of the former sections.

In the sand test the average growth in height of plants grown from kernels selected from the third fourth section was 4.5 inches per plant, and the average in height growth from those produced from the butt section was 3 inches per plant, making a difference of 1.5 inches per plant in favor of the former. The average height of plants grown from the tip kernels, also of those grown from the second fourth section was 4 inches, making a difference of .5 inch per plant in favor of plants produced from kernels that had been selected three fourths from the butt end.

The greatest average width per leaf in the soil test was made from plants grown from kernels selected from the

third and second fourth sections. This average was 1 inch per leaf, making an increase of .375 of an inch over the leaves from the tip section, and .250 of an inch greater than plants produced from the butt end kernels. In the sand test the average width per leaf was 1 inch per plant for all sections except the tip. In the tip section the average width was .75 of an inch per leaf.

The average diameter per plant in the soil tests was .2915 of an inch per plant for plants grown from kernels selected two fourth from the butt, and .2500 of an inch per plant for the plants of the remaining three sections, making a difference of .0415 of an inch in favor of the plants produced two fourths from the butt end.

In the sand test the plants produced from kernels selected three fourths from the butt averaged 6.599 grams per plant, while those grown from the butt end kernels averaged 2.908 grams per plant, making a difference of 3.691 grams per plant in favor of the section three fourths from the butt end.

General Average of Tables I., II., III. and IV.,
Corn Experiments.

Total number of seed planted:

Soil tests.....375.

Sand tests.....135.

Total number and percent of seed germinated:

	<u>Soil tests.</u>		<u>Sand test.</u>	
	Number	Percent.	Number	Percent.
Tip.....	351	93	118	87
Third fourth.....	363	96	110	81
Second fourth.....	345	92	116	85
Butt.....	343	91	111	82

Average growth in height per plant:

	<u>Soil tests.</u>		<u>Sand test.</u>	
Tip.....	14.00	inches.	5.33	inches.
Third fourth.....	14.25	"	3.50	"
Second fourth.....	13.75	"	5.00	"
Butt.....	13.00	"	4.00	"

Average width per leaf:

	<u>Soil tests.</u>		<u>Sand tests.</u>	
Tip.....	.531	inches.	.750	inches.
Third fourth.....	.704	"	.833	"
Second fourth.....	.979	"	.833	"
Butt.....	.916	"	.833	"

Average diameter per plant:

	<u>Soil tests.</u>	<u>Sand test.</u>
Tip.....	.166 inches.	.208 inches.
Third fourth.....	.239 "	.250 "
Second fourth.....	.260 "	.250 "
Butt.....	.166 "	.250 "

Average weight per plant:

	<u>Soil tests.</u>	<u>Sand test.</u>
Tip.....	3.020 grams.	.692 grams.
Third fourth.....	3.697 "	1.038 "
Second fourth.....	3.130 "	.962 "
Butt.....	3.167 "	.972 "

SUMMARY OF TABLES I., II., III., IV.

In the soil tests the greatest number of plants were produced from kernels selected from the section three fourths from the butt.

In the sand test the greatest number of plants were produced from kernels selected from the tip of the ear.

Greatest growth in height was made:

In soil tests: From kernels selected from the third fourth section.

In sand test: From kernels selected from the third fourth section.

The widest leaves per plant:

In soil tests: From kernels selected from the second fourth section.

In sand test: From kernels selected from the third fourth; second fourth and butt averaged the same.

Greatest diameter per plant:

In soil tests: From kernels selected from the second fourth.

In sand test: From kernels selected from the third fourth; second fourth and butt averaged the same.

The heaviest plants were produced:

In soil tests: From kernels selected from the second fourth.

In sand test: From kernels selected from the second fourth.

Soil tests.

It will be seen from these data, that the kernels selected two-fourths from the butt end produced the best plants, and the kernels selected three-fourths from the butt end produced the second best plants.

Sand tests.

Kernels selected three-fourths from the butt end produced the best plants, and kernels selected two-fourths from the butt end produced the second best plants.

This shows that kernels selected from the second and third quarter sections of an ear of corn yield better plants than kernels selected from the tip and butt portions.

University of Missouri - Columbia

010-100695767

93978