



101
346
THS



MICHIGAN STATE UNIVERSITY LIBRARIES

3 1293 10768 8123

LIBRARY
Michigan State
University



RETURNING MATERIALS:
Place in book drop to
remove this checkout from
your record. FINES will
be charged if book is
returned after the date
stamped below.

MAGIC 2

NOV 05 1998

SENIOR AGRICULTURAL THESIS.

"THE GROWTH OF SEEDS"

MARY C. BAKER.

Michigan Agricultural College, 1898.

THESIS

THE GROWTH OF SEEDS.

The object of the experiments carried on was to ascertain the manner in which the seeds of the different vegetables freed themselves from the seed-coat when germinating. The nine kinds of seeds experimented with furnish examples of nearly all the forms of cotyledons to be found among the cultivated vegetables. They were squash, black lima and bush beans, sweet corn, peas, tomato, radish, beet and onion. The corn and onions represented the monocotyledonous, and the others the dicotyledonous plants and the beans and peas furnished examples of fleshy cotyledons.

The seeds were planted in boxes, one side of which was a glass slide, and drawings were made at intervals of two or three days, according to the rapidity of growth at the different stages of development up to the time when the first true leaves appeared. In the case of the larger seeds they were planted in different positions and at depths varying from one-fourth to two inches. The depth of covering did not have a very marked effect; excepting in the time of appearance of the plant, - those nearest the surface usually appearing about a day earlier than those which were covered one and a half to two inches. The position of the seed, however, had a marked effect in most cases except those of the beet and onion where it was not very apparent. In one instance, (Fig. 2, IV) the cotyledons of a kernel of corn which had been planted with the point upward, grew downward, under the seed, and up on the other side, very nearly

encircling it.

The manner in which the cotyledons freed themselves from the seed coat differed greatly in most of the kinds of seeds. Fig. 122 I.
In the squash a small projection or hook, just above the root, caught the edge of the outer covering and held it firmly down while the cotyledons gradually drew upward and out. The empty shell remained for some time attached to the hook; but finally became dislodged and disappeared. In one case, where the seed was planted with the point downward, the hook was not brought into a position where it was able to hold the seedcoat which was carried above the ground with the cotyledons still enclosed, - one being entirely and the other about half covered. The portion of the cotyledon which was outside of the seedcoat grew a very little and the thickness was much greater than that of the normal cotyledons. In the portions which remained covered, there was no development whatever and the cotyledons became yellowish-brown and very brittle. The growth of the plant was very slow, the increased size during one week being very little more than that of an ordinary plant in one day.

The removal of the seed-coat was the same in both kinds of II. III. beans. The thin outer covering became cracked across in several places by the expansion of the cotyledons and was apparently rubbed off as the plant pushed its way through the soil, being entirely gone by the time the plant reached the surface.

The cotyledons of the corn IV. pushed aside the portion of the seed-coat which covered the germ, leaving the remainder intact.

The seed which remained attached to the plant for some time, gradually became shrunken and withered and finally disappeared.

In the peas,^V the cotyledons of which remained under ground, the seed-coat was somewhat broken but remained on the seed.

The seed-coat of the tomato was opened at the point,^{Fig. 1, VII.} the root forcing its way out first and the cotyledon gradually withdrawing. In some cases the seed-coat remained attached to the root of the plant;^{Fig. 3, VII.} but as a usual thing it was carried to the surface of the ground by the cotyledons before they entirely freed themselves from it. The depth at which the seed was planted influenced this greatly. Seeds which were planted from one to one and a half inches deep were much more liable to leave the seed-coat attached to the root than those planted less deeply, while those planted just below the surface almost invariably brought the seed-coat above the ground.

In the radish the seed-coat was first broken by the root ^{Fig. 1, VII.} then gradually split apart and forced off by the expansion of the cotyledons.^{Fig. 3, VII.}

The beet seeds ^{VIII.} somewhat resembled the tomato seeds in the manner of their germination, especially in the way the cotyledons withdrew from the seed-coat and in their tendency to carry it above ground, which was rather greater than in the tomato seedling, - the seed-coat often remaining attached to one of the cotyledons for some time after they unfolded.

In the case of the onion ^{IX} the root forced its way through

the seed-coat in much the same manner as the tomato; the seed-coat, however, remaining fixed on the seed until the plant had made a considerable growth. *Figs, X.*

In the tomato, beet, onion and radish there was, to a certain extent, a similarity in the way in which the outer covering of the seed was thrown off. Among the larger seeds, however, there was little or none of this, except in the beans and this was a case where a similarity of growth would be almost inevitable. There was also a certain degree of similarity of growth in some of the young plants but the kinds were too widely separated to show any great likeness.

I

Mamie Baker.

Squash Seed.



a. Seed coat.

b. Cotyledons.

c. Root.

x. A hook or point which holds the seed coat and prevents its being carried above the ground by the cotyledons.

1. Seed three days after the beginning of germination, the hook still within the seed coat.

2. The hook holding the seed coat so that the cotyledons can be drawn out.

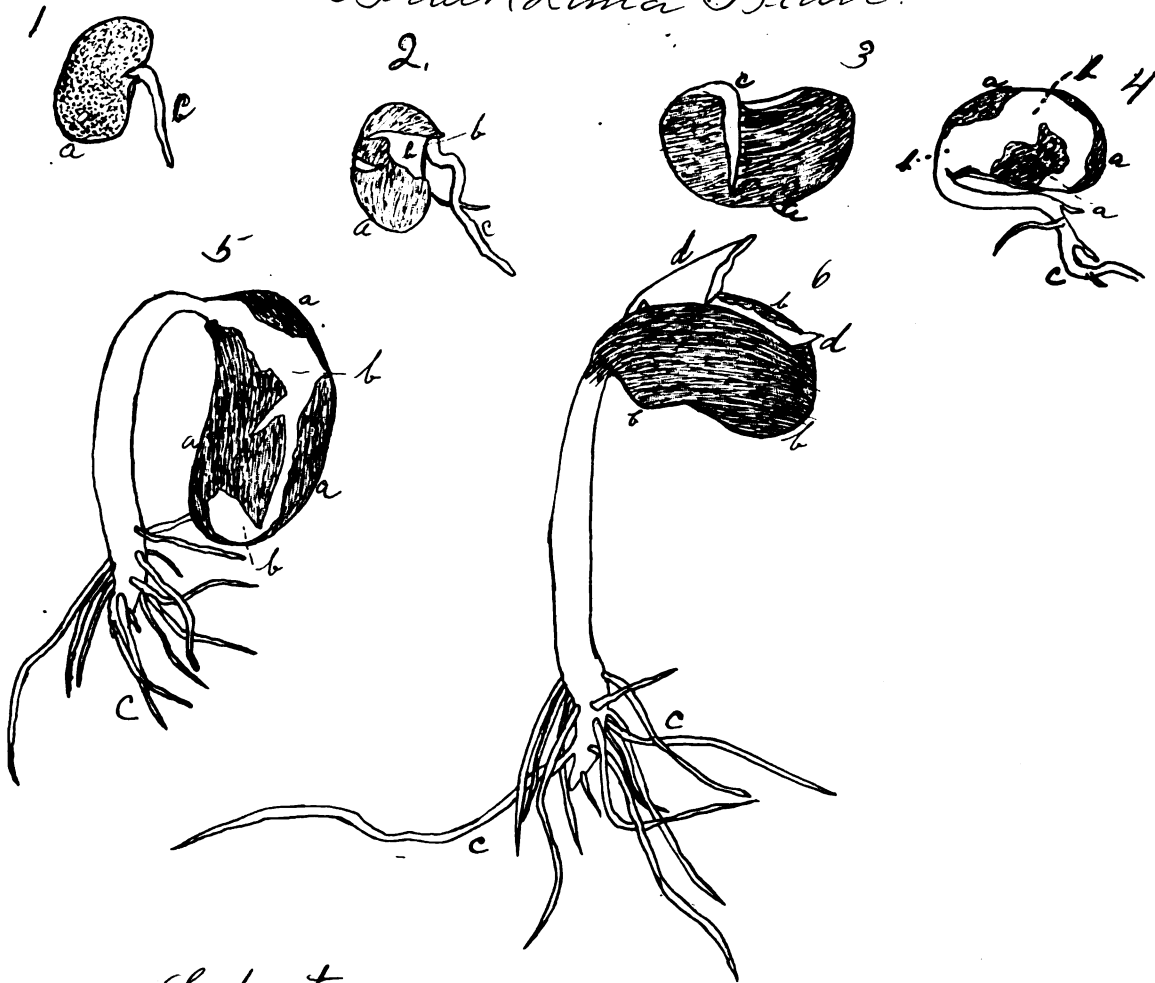
3. The cotyledons released from the seed coat but not yet unfolded, the seed coat still adhering to the hook.

4. The cotyledons unfolded.

II

Mamie Baker.

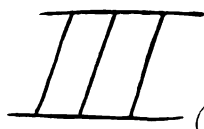
Black Lima Bean.



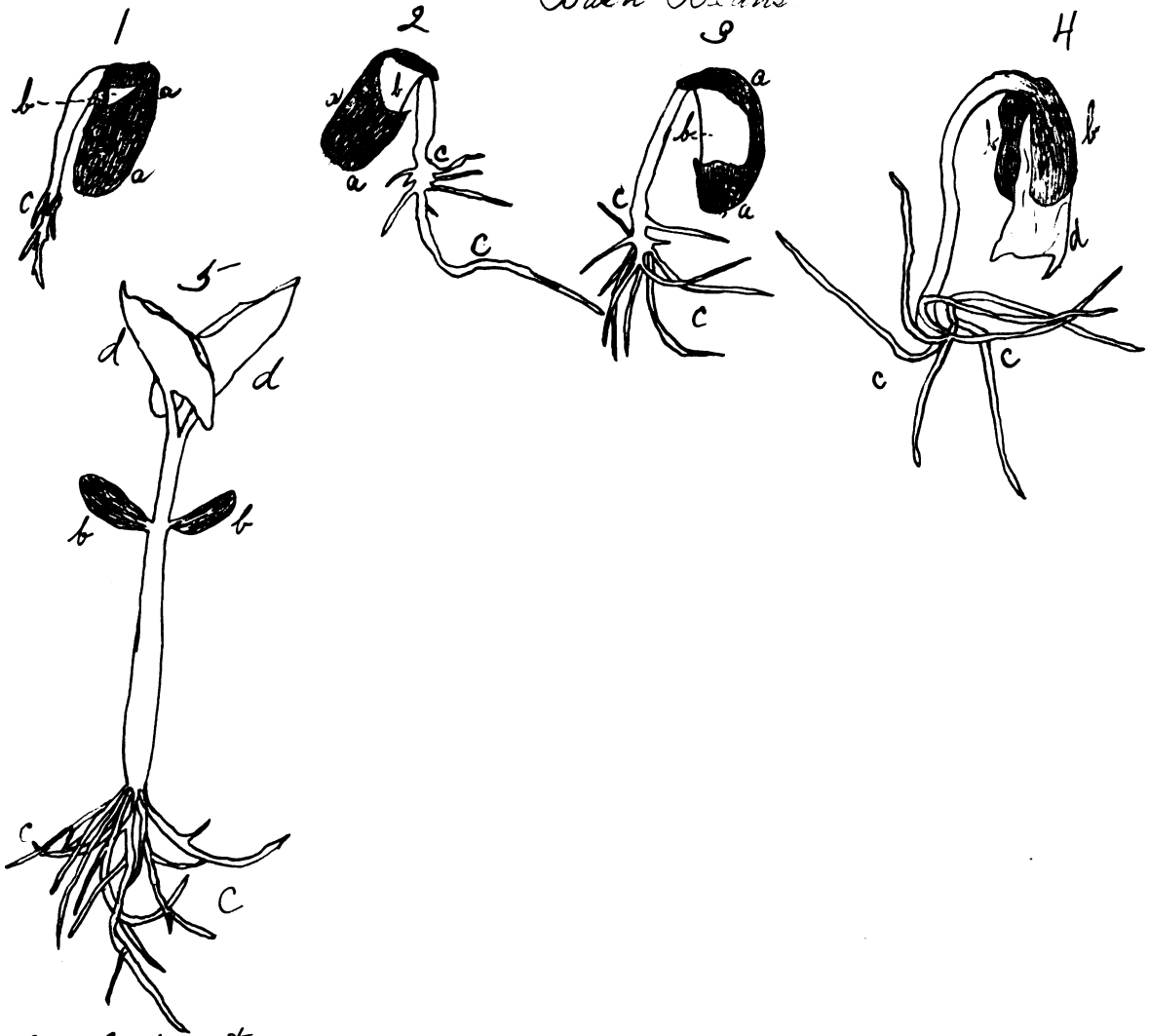
- a. Seed coat.
- b. Cotyledons.
- c. Root.
- d. True leaves.

1. Bean after three days growth.
2. Bean after four days growth, the seed coat broken in several places.
3. Bean showing the effect of planting with the cotyledons turned downward. The root growing downward across the cotyledons.
- 4.-5. The seed coat broken and much of it disappeared. 5. Showing also the root distribution.
6. The cotyledons opening showing the true leaves.

Mamie Baker.



Bush Beans



- a. Seed coat.
- b. Cotyledons.
- c. Root.
- d. True leaves.

1. Seed three days after germination.
2. Seed showing the manner in which the seed coat opens.
3. A later stage of 2.
4. The seed coat entirely gone. The cotyledons partly open showing the true leaves.
5. The plant erect. The leaves unfolded.

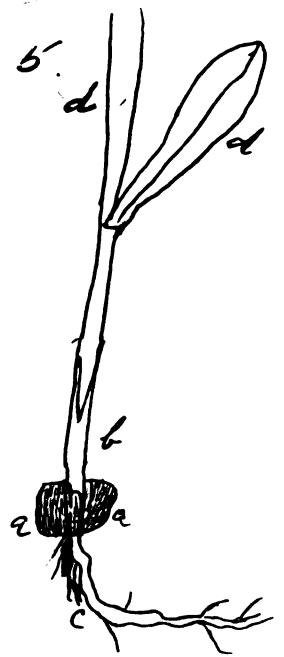
IV

Sweet Corn

Minnie Barker



4



a. Seed coat.

b. Cotyledons.

c. Root.

d. True leaves.

1. A kernel planted point downward.

2. A kernel which was planted pointing upward. The root grew upward for a short distance then turned down.

3. A later stage of 2.

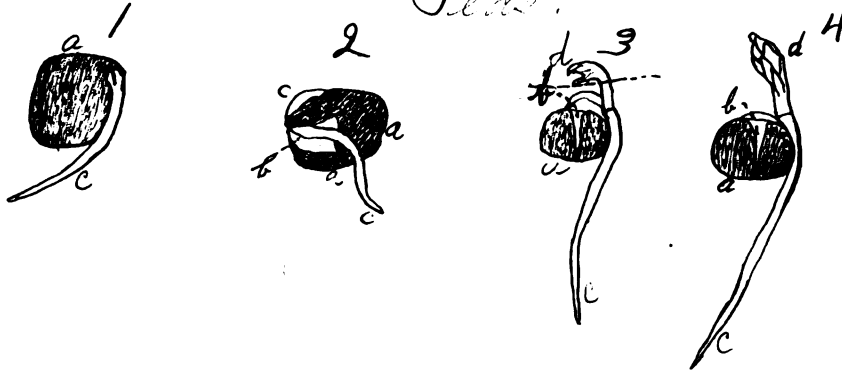
4. The true leaves extending beyond the cotyledons but still rolled.

5. The cotyledons somewhat withered at the base of the plant the first leaves unfolded.

Mamie Baker.

V

Pear.



a. Seed coat.

b. Cotyledons.

c. Root

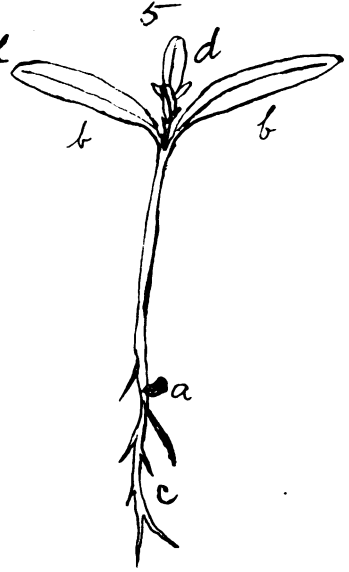
d. True leaves

1. The root growing directly downward. The seed coat still whole.
2. The seed coat cracked apart showing the cotyledons. The root growing from above the cotyledons.
3. The true leaves just appearing above the ground.
4. The leaves just beginning to unfold.

VII

Tomato Seeds

Nannie Baker



a. Seed coat.

b. Cotyledons.

c. Root.

d. True leaves

1. The germinating seed magnified.

2. The same not magnified

3. The plant still bent, the cotyledons partly open, the seed coat still adhering to the root

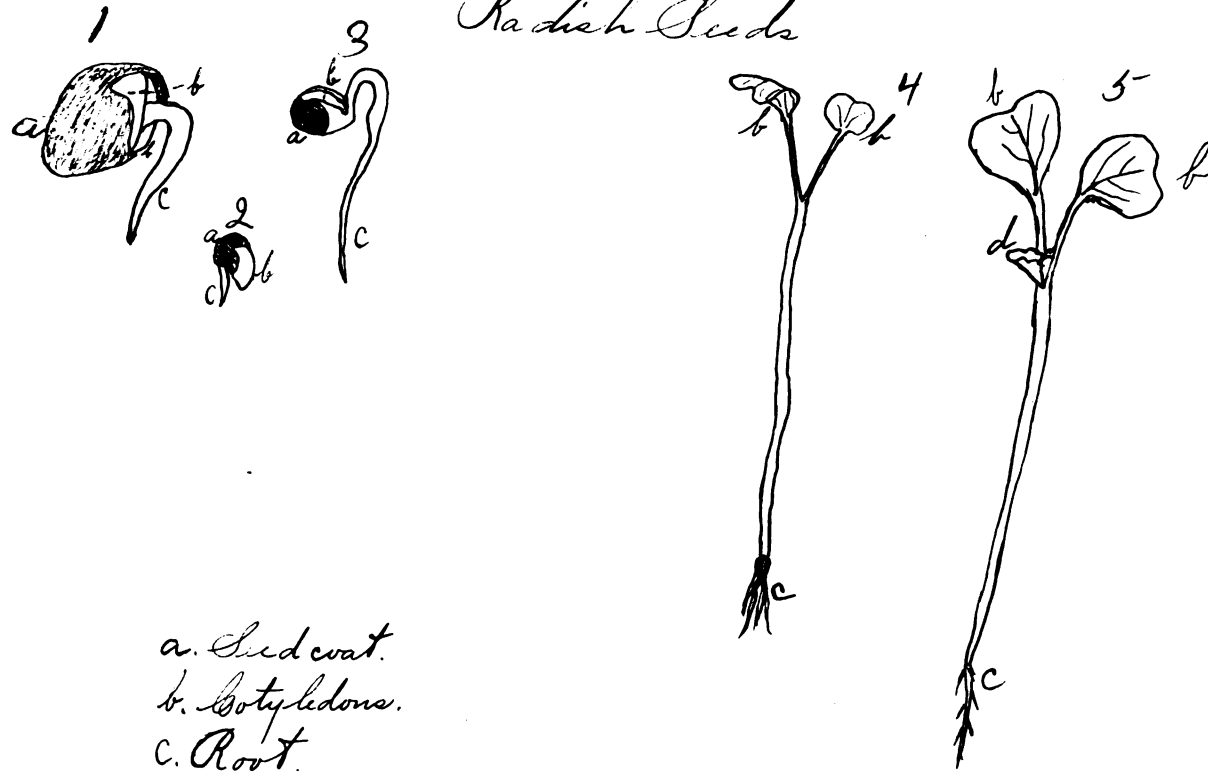
4. The plant erect and the cotyledons unfolded.

5. The first leaves started.

VII

Mamie Baker.

Radish Seeds



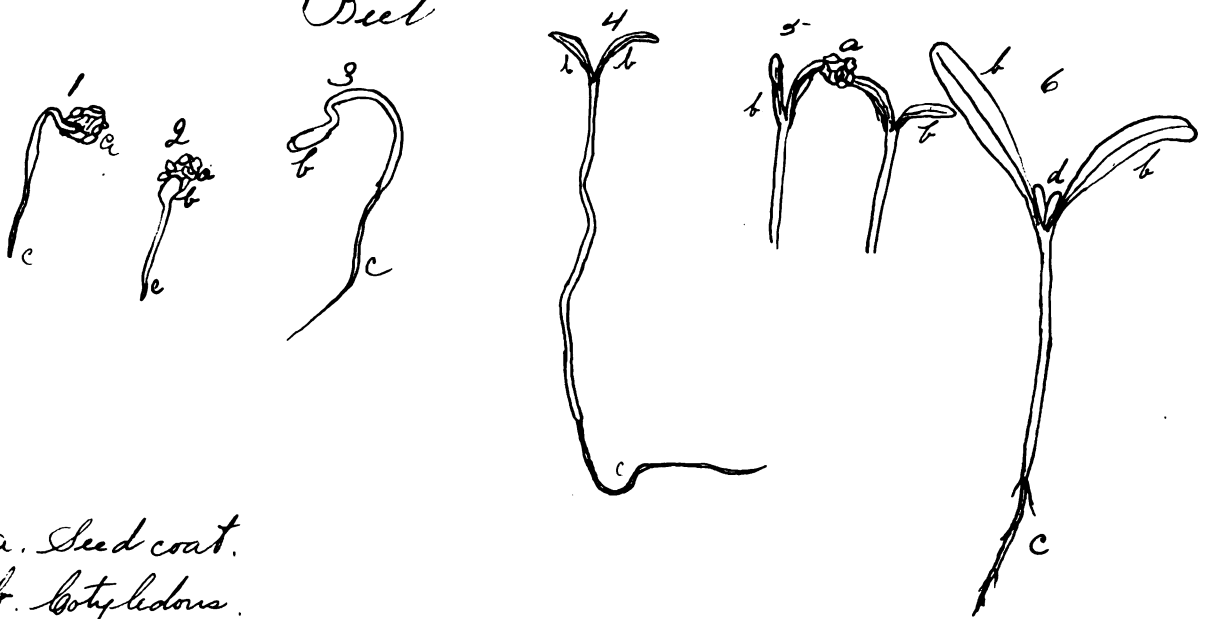
- a. Seed coat.
- b. Cotyledons.
- c. Root.
- d. True leaves.

1. The seed coat broken apart showing the cotyledons. The seed magnified.
2. The same as one, not magnified.
3. The seed coat split by the expanding cotyledons.
4. The plant with the cotyledons fully unfolded.
5. The first leaves just showing between the cotyledons.



Beet

Namie Baker.



a. Seed coat.

b. Cotyledons.

c. Root.

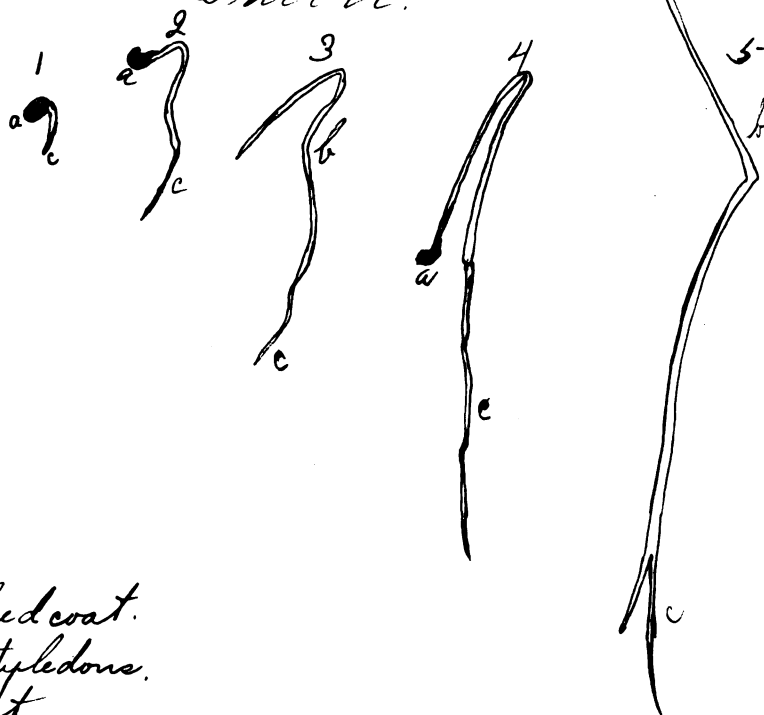
d. True leaves.

1. The germinating seed, only the root showing, the cotyledons still within the seed coat.
2. A later stage, the cotyledons partly withdrawn from the seed coat.
3. The plant with the cotyledons still folded together.
4. The cotyledons unfolded.
5. A seed coat adhering to two plants.
6. The first leaves showing between the cotyledons.

IV

Onion.

Mamie Baker



a. Seed coat.

b. Cotyledons.

c. Root.

d.

1. The seed showing the root only.

2-3-4-5. Later stages of growth.



Q 1/11 2-10-12

MICHIGAN STATE UNIV. LIBRARIES



31293107688123