A STERILE CHARACTER IN SOYBEANS

F. V. OWEN

(WITH TWO FIGURES)

In 1924 a progeny of Manchu soybeans was found to be segregating for sterility. The segregation has since proved to be very clear-cut and a single factor mutation is held to be responsible for the results. Careful records had also been taken of the parental plants for two previous generations so it is quite certain that the origin was by means of a genuine mutation and not merely a heterozygous selection.

The following results were obtained by growing seed from the plant (No. 26-5-11) which bore the first sterile seeds.

<table>
<thead>
<tr>
<th>Normal plants</th>
<th>Sterile plants</th>
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</thead>
<tbody>
<tr>
<td>Observed</td>
<td>83</td>
</tr>
<tr>
<td>Calculated</td>
<td>83.2</td>
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The segregation of the progeny happened to be almost perfectly in line with expectation. Approximately two-thirds of the normal segregates also proved to be heterozygous for the sterility factor in the next generation so there is little doubt about the mode of inheritance.

The exact cause of this sterility has not been determined but apparently the ovule is non-functional as well as the pollen grains. At first it was hoped that the sterility factor had effected a wholesale emasculation for convenience in hybridization, but all efforts to produce seeds on sterile plants have failed. Pollen grains are formed which appear to be normal until the anthers are about to dehisce, but at this time they take on a shrunken appearance which makes it very easy to classify normal and sterile plants microscopically. Heterozygous plants appeared perfectly normal in all respects.

The physiology of sterile plants

The behavior of the sterile plants after flowering is of special interest because growth in soybeans is largely determinate. After the first flowers drop from the sterile individuals there is frequently a second flowering and small pods are sometimes formed, but no ovules have ever developed and the sterility has been complete in every case.

These sterile plants are perfectly normal during the early stages of growth but after flowering time there are noticeable differences between normal and sterile plants. Sterile plants take on a much darker green

1 From the Department of Genetics, paper no. 90 Wisconsin Agricultural Experiment Station. Published with the approval of the director of the station.
color, the leaves thicken, and the stems sometimes become greatly enlarged. Furthermore, the leaves on these plants remain green and firmly attached to the stem long after normal segregates have matured. Fig. 1 shows the characteristic form of a sterile plant, and fig. 2 the contrasting normal individual.

Fig. 1. Where can this plant store its soybeans? The chief significance of this sterile character lies in the nature of growth after flowering time. The plant still elaborates food material, but the determinate type of growth prevents the formation of new shoots. With storage channels all cut off, this "manufacturing establishment" becomes saturated with the very materials which it was designed to produce. There is a single factor difference between sterile and non-sterile plants.

No test of starch has been secured in the stems of normal plants after maturity but the iodine test has indicated the presence of considerable starch in the stems of sterile plants at the end of the season. This condition is to be expected because these sterile plants must be synthesizing considerable food material all the time, but the parenchymatous cells of the leaves and stem seem to constitute the only storehouse available. The whole situation, therefore, is quite like a modern canning factory that runs short of the usual tin cans. The section of the factory where raw materials are taken in may work ever so efficiently at first but it soon becomes congested from lack of storage containers.
The peculiar behavior of sterile plants, naturally deprived of a store-
house for elaborated food material, has also been of interest in connection
with a study of mottling of the seed coat because of a possible connection
between the two phenomena. In previous studies (2) abnormal plants
have been described which resembled sterile plants very much in that the
leaves thickened and turned a dark green color. These abnormal plants
developed an extreme amount of mottling in the seed coat, and it is assumed
that the excess accumulation of elaborated food material was associated
with the development of glucosidal pigments.

![Image](https://example.com/image1)

**Fig. 2.** Normal plant with plenty of pods for storage space. The seeds of normal
plants make a natural storehouse for elaborated food material. It is believed that this
is a very important factor in determining the ultimate efficiency of normal thrifty plants.
This normal plant is a sib to the sterile individual shown in fig. 1.

It is hoped that a more thorough knowledge of the physiological pecu-
liarities of sterile plants of this sort may sometime be available. Mur-
neek's (1) interpretation of the stimulus given to a plant by setting fruit
is very interesting and it seems natural to suppose that a plant should be at
its maximum metabolic efficiency after a full growth of foliage has become
established, provided that good storage channels are available. It is likely
that a more careful study of plants entirely deprived of reproductive or-
gans might also be pursued with profit. The soybean should be particu-
larly well adapted for such studies because of the determinate type of
growth.

Maine Agricultural Experiment Station,
Orono, Maine.
LITERATURE CITED
