A PRELIMINARY REPORT ON POSITIVE PHOTOTROPISM VS. NEGATIVE GEOTROPISM AS A DETERMINING FACTOR IN THE DIRECTIONAL GROWTH OF STEMS*

H. L. Chance and D. H. Foster

Norman, Oklahoma

INTRODUCTION

When green plants receive light from all points of the compass the growth is in a perpendicular position. But if these plants receive light from one side only the plants assume an inclined position toward the source of light. In the first case the two influences, negative geotropism and positive phototropism are acting in the same direction and growth is perpendicularly upward. In the second case the two influences are acting at right angles to each other with the results mentioned. What position will the stem and roots assume if these two influences can be brought to directly oppose each other? Does one influence directional growth more than the other, if so which one?

Four six-inch pots were prepared and planted. Pot one, contained wheat and oats; pot two, buckwheat and sunflowers; pot three Canada field peas and mung beans; pot four, white mustard and balsam. The top of each pot was covered with a half-inch mesh screen wire. The pots were kept in the green house until the seedlings were from one to three inches high, and then placed in an inverted position in a light proof box.

The box was eighteen inches square by seven and a half feet in length. Provision was made for the control of temperature, moisture and humidity.

The pots were placed in position late in the afternoon and remained in darkness until 10:00 a. m. The position assumed by the plants during this period was as follows: wheat, oats and buckwheat still pointed down; peas and beans tips turned up markedly; sunflowers, mustard and balsam had turned up against the wire which covered the pot.

Light from a 1000 watt bulb was turned on at 10 a. m. The bulb was submerged one-half inch in cold running water, and maintained approximately thirty inches below the plants.

After a period of six hours all plants which had turned upward during the night, except the sunflower and balsams, had turned down directly toward the light. With few exceptions this position was maintained throughout the experiment.

The wheat, oats and mung beans ceased to grow and died about two weeks after the experiment started. The wheat and oat seedlings reached an average length of about 14 inches while that of the mung beans was about 10 inchs. All these plants were pointing downward.

The experiment was started on the eighth day of March. The remaining plants were harvested the nineteenth of May. Two buckwheat plants reached the length of 64 inches, both plants having bloomed profusely, one producing fruit. Twelve others reached an average length of 36 inches, seven of which were in bloom at harvest. All these plants were green and vigorous at harvest.

One pea plant was 84 inches long at harvest, and apparently still growing in length though the lower leaves had long since died. One other bean plant was 38 inches long while the average of three more plants

* Contribution from the Botanical Laboratory of the University of Oklahoma, N. S. No. 37.

was 18 inches. Only one malformed flower was produced on the large plant.

Observations upon the root systems revealed a relatively small development in all cases, but the roots appeared to be well distributed throughout the soil.

Buckwheat seedling from 2-3 inches high were placed in a light proof box with the shoots in a horizontal position. A 150 watt light submerged three-eighths of an inch in cold running water was placed 18 inches below the seedlings. Five hours later most of the plants had turned directly downward. The seedlings were now turned so that the shoots pointed upward. Twenty-four hours later the seedlings were again pointing toward the light.

A preliminary survey reveals that some plant stems are more influenced in directional growth by light than by gravity and vice versa. Work to date indicates that four species, buckwheat, Canada field peas, white mustard, and four o'clocks are more strongly influenced in directional growth by light, while sunflowers, balsam, mint and ash are more strongly influenced by gravity.

✦ ✦ ✦ ✦