RELATION OF THE EFFECTS OF GROWTH-PROMOTING SUBSTANCES TO PHOTO-SYNTHETIC ACTIVITY, THE MASS LAW OF GROWTH AND SEED GERMINATION

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Part I. Photosynthetic Activity and the Mass Law of Growth. Although a review of the literature on growth-promoting substances gives evidence of their interaction with photosynthesis and the mass law of growth, little if anything is stated concerning the nature of this relationship. It seemed desirable therefore to determine first whether such interaction exists and secondly to determine the nature of the relationship.

The writer germinated two lots, A and B, of seed of *Phaseolus nanus* Auth. Var. Stringless Green Pod in a saw-dust medium. Seeds in lot A were germinated in the light while those in lot B were germinated in a darkroom. When the seedlings had reached a height of about five inches, cuttings were made of both lot A and lot B by cutting the plants one inch above the medium. The cuttings of both lots were similarly treated with Hormodin A (indole-butyric acid) solutions of 1.0, 0.50, and 0.25 per cent concentration for twenty-four hours and were then placed in a moist sand medium. The cut-

tings of lot B were kept in the dark while those in lot A remained exposed to the light. Controls were handled in the same manner but were placed in distilled water for twenty-four hours instead of in an Hormodin A solution before placing into sand.

The cuttings were photographed seven days after treatment. Photograph 5 shows the darkroom beans while photograph 7 shows the beans grown in the light. The letters designate concentration of the treating solution: A—1.0%; B—0.50%; C—0.25%; D—control. The photographs show: 1. That more roots are produced in light than in darkness.

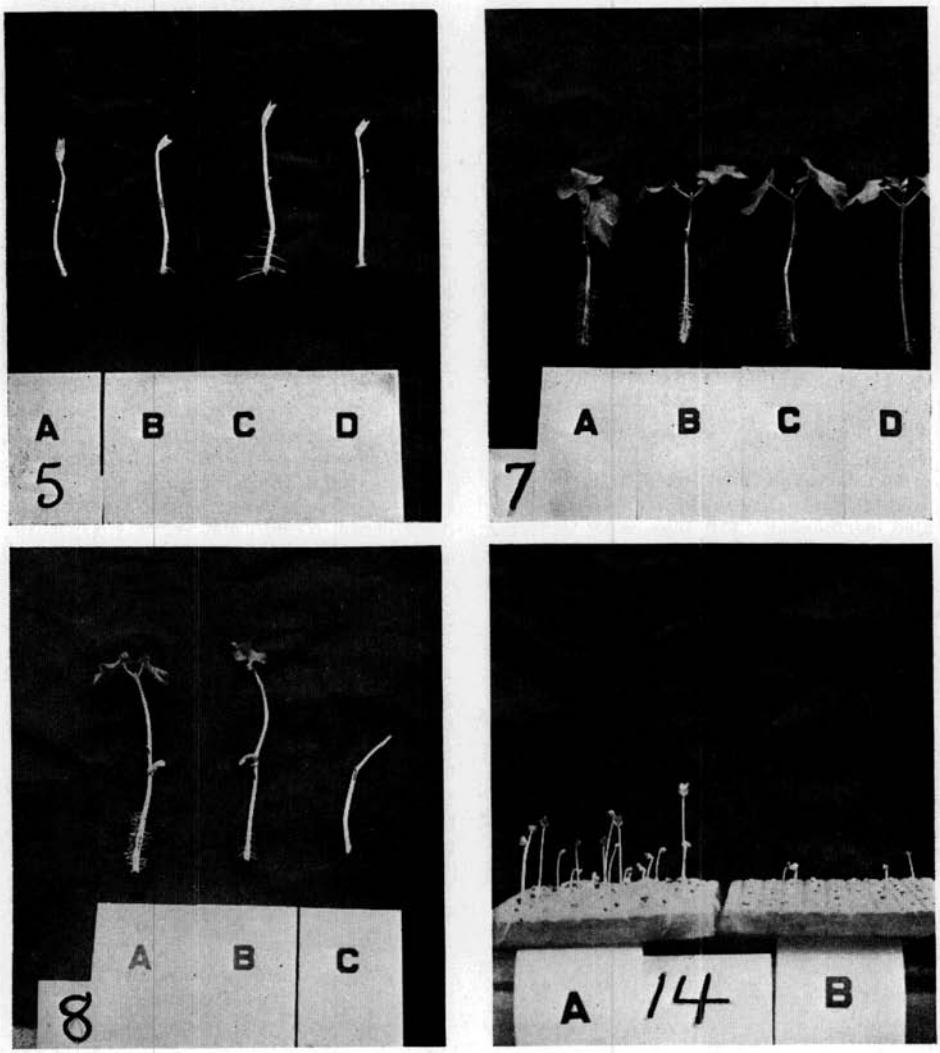

Fig. 1

Photograph 5. Bean seedlings grown in the dark. **Photograph 7.** Bean seedlings grown in the light. **Photograph 8.** Bean seedlings showing effect of leaf area on rooting. **Photograph 14.** Radish: A=Control; B=Seeds treated with powder containing propionic acid.

2. That the roots produced by plants in light decrease in number with a decrease in concentration of the treating solution.

If it is true that there is a correlation between growth-promoting substances on one hand and photosynthetic activity and the mass law of growth on the other, the amount of rooting should be more or less proportional to the size of the cutting and especially to the leaf area. In order to study this relationship an experiment using cuttings of lot A was performed. The cuttings were divided into three sets as follows: In the first set, all leaves were left intact on cuttings; in the second set, half of the leaves were removed; in the third set, all of the leaves were removed. All cuttings were treated for twenty-four hours with a 0.50% Hormodin A solution and were then placed in a moist sand medium.

Eight days after treatment representative cuttings were photographed. See Photograph 8. A dry weight determination of the roots was also made. This shows the weights to be in a ratio of 100:60:1 which correlates very closely with the ratio of the leaf area of 100:50:1.

Another experiment on *Zebrina pendula* Schnizl and *Coleus blumei* Benth. was also performed. Cuttings with different leaf areas were treated for twenty-four hours with a 0.50% Hormodin A solution and placed in a moist sand medium for twenty-one days. It was found that the number and length of roots on a cutting increased with an increase in leaf area to the point where wilting took place. Wilting takes place when the leaf area becomes so great that more water is lost by transpiration than can be taken up by the stem.

Part II. Seed Germination. Reports have been made in the literature that treatment of seeds with growth-promoting substances increases the rate and percentage of germination. It was the object of these experiments to test a few of the substances. Seeds of *Zea mays* L. var. Yellow Dent, *Phaseolus nanus* Auth. var. Stringless Green Pod, and *Raphanus sativus* L. var. White Icicle were treated with a powder containing indole-propionic acid. They were germinated as follows: Some were placed between paper towels on moist saw-dust, some on clay germination blocks made for this purpose by the Ceramics Department of the University of Illinois, and others were planted directly in rich loam soil in the greenhouse benches. Controls were not treated but were germinated as the above.

Results show: 1. A retarded and lower percentage germination among the treated seeds. 2. A slower rate of growth among the seedlings produced by the treated seeds. See Photograph 14.

In another experiment seeds of the above plants were treated for eighteen hours with solutions of indole-butyric acid. During the treatment the solutions were kept at temperatures of 0, 4, 12, 20, and 35 degrees centigrade and the concentration range in percentage was as follows: Controls, 0.002, 0.004, 0.008, 0.016, 0.032, 0.064, 0.128, 0.256, 0.512, 1.0, 2.0, 4.0, 8.0. The seeds were then germinated on germination blocks.

Results show: 1. A retarded germination in all seeds treated except in the case of *Zea mays* where there was a slight stimulation. 2. Solutions kept at 20 degrees centigrade during treatment show the greatest stimulation in the germination of *Zea mays* and the least retardation in the seeds of the other species. 3. The optimum concentration of the treating solution according to this experiment is 0.512 of one per cent.