Absorption of 2,4-D by Corn and Pea Seeds

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Absorption of 2,4-D into plant tissues has been studied specifically in only a few investigations. Rice (5) found absorption of the ammonium salt of 2,4-D by red kidney bean leaves to be correlated with temperature and found it to be greater in darkness than in light. Weintraub and Brown (7), however, found that translocation of exogenous growth regulators took place only if plants were allowed to photosynthesize or were supplied with an external source of sugar. Bryan et al. (3), in one of the more complete investigations on this topic, studied the effect of temperature, sugars, and wetting agents on absorption of 2,4-D by soybean leaves. They found that addition of various sugars, use of wetting agents, and moderate increases in temperature all increased the apparent absorption of 2,4-D.

The experimental results presented here show the effect of pH on 2,4-D absorption by corn and pea seeds and the widely differing abilities between seeds of these two species to absorb 2,4-D from an aqueous solution.

METHODS

In Experiment I the effect of pH and various buffers on 2,4-D absorption was studied by soaking corn seed in phosphate, glycerolphosphate, and citrate buffers made up at 0.05 molar concentration and containing 2,4-D as the sodium salt at 0 or 500 ppm on the acid equivalent basis. Portions of solution containing each buffer were adjusted to pH values of 8.0, 7.0, 6.0, 5.0, and 4.0 using potassium hydroxide and hydrochloric acid. Duplicate 50 ml aliquots of each of the 30 solutions were placed in small bottles with 50 kernels of Wisconsin 595 hybrid corn. The corn seed was soaked for 20 hours at 28° C after which pH values of the solutions were determined. After the soaking period the unabsorbed solution was stored with one drop of toluene in a refrigerator at 4° C until assayed for 2,4-D. Seed samples were weighed prior to soaking for 20 hours at 28° C after which pH values of the solutions were determined. Fifteen grams of pea seed and 40 grams of corn seed were soaked for 20 hours in each of the 30 solutions. The solution remaining was diluted to a concentration that would have been 1 ppm of 2,4-D from the original solution. The duplicate samples of soaked seed were bulked and mixed. Four replicates of 10 seeds each were counted out and planted in greenhouse flats arranged in randomized complete blocks to determine their viability and vigor.

Phosphorus concentrations were measured in the glycerolphosphate buffers before and after soaking to determine whether 2,4-D and phosphorus intake were affected by various pH levels.

The assay of 2,4-D in the residual solutions was carried out as soon as possible after the soaking period. This involved surface sterilizing seeds of Wisconsin 595 hybrid corn in 50% ethyl alcohol containing 0.1% mercuric chloride. After each seed was then thoroughly washed in distilled water and placed between filter papers in each of several 10 cm petri dishes, and 10 ml of an unknown or standard solution was added. Unknown solutions were adjusted to dilutions of 0.5, 1.0, 2.0, 5.0, and 2.0 ppm, approximately. Standard concentrations were made up consisting of 0, 0.5, 1.0, 2.0, 3.0, and 5.0 ppm. Treatments were made for each of the unknowns and standard concentrations. Standard solutions consisted of water. Unknown solutions contained materials less as well as certain buffering agents. However, weakness of unknowns for assay of 1 ml in 500 ml of seed of the two species nor the buffering agents altered seedling growth or response to 2,4-D for assay. A small wire staple was placed over the dish to ensure aeration. The germination was allowed in an incubator with temperature controlled at 28° C. At the end of this period primary root lengths were measured on an equal sample basis.

In Experiment II the effect of pH on uptake of 2,4-D was studied using pea and corn seed at various pH levels. Samples of 100 corn and Alaska variety pea seeds were soaked for 20 hours in 50 ml of 500 ppm 2,4-D solution at pH 4 and 7 with 0.025 molar phosphate and hydrochloric acid. Duplicate 50 ml aliquots of each of the 30 solutions were placed in small bottles with 50 kernels of Wisconsin 595 hybrid corn. The corn seed was soaked for 20 hours at 28° C after which pH values of the solutions were determined. After the soaking period the unabsorbed solution was stored with one drop of toluene in a refrigerator at 4° C until assayed for 2,4-D. Seed samples were weighed prior to and after soaking to determine the volume of solution absorbed. The duplicate samples of soaked seed were bulked and mixed. Four replicates of 10 seeds each were counted out and planted in

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