

THE EFFECT OF DIAMMONIUM PHOSPHATE FERTILIZER ON THE GERMINATION OF *PAULOWNIA TOMENTOSA* SEEDS¹

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The germination of paulownia seeds was significantly reduced by soaking the seeds in an aqueous solution of diammonium phosphate fertilizer at concentrations frequently used in hydroseeding.

Hydroseeding is frequently used to establish vegetation on surface-mined lands in the Eastern United States. In this method, an aqueous mixture of seeds, fertilizer, and sometimes woodfiber mulch is applied to areas requiring revegetation.

In the Southern Appalachian Region, paulownia (*Paulownia tomentosa*), a tree indigenous to China, seems especially well adapted to the harsh environmental conditions of surface mines. The seeds of paulownia are small, about 6,000 seeds to 1 gram, and are easily disseminated by wind. Through natural regeneration, the species has become well established on several surface mines in southeastern Kentucky.

Attempts to direct seed paulownia by hydroseeding on surface mines have been largely unsuccessful. This may be due to a

combination of factors. Paulownia seeds have an unusually high light requirement (1); and on surface mines, seedlings are most frequently observed on south slopes where solar radiation is highest (3). Also the seeds of paulownia are small and are subject to cyclic desiccation on surface mine spoil

where surface temperatures are frequently high and dry conditions occur. Finally, several investigators have reported loss of viability prior to sowing, particularly where seeds remained in the hydroseeder tank in a fertilizer solution for extended periods (2, 6, 7).

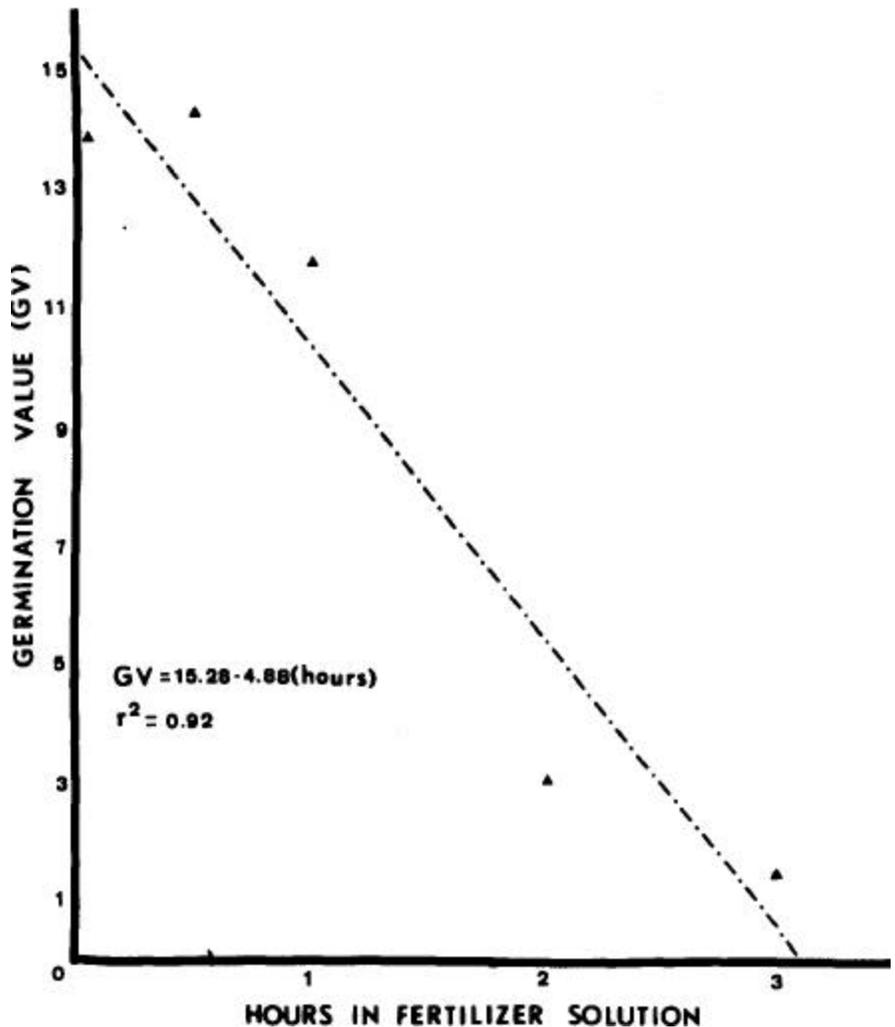


Figure 1.—Influence of time in fertilizer solution on the germination value of paulownia seed.

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The present laboratory study was undertaken to assess the effects of diammonium phosphate fertilizer on seed viability. It was designed to provide information on the optimal time paulownia seed should be immersed in fertilizer solution without significant loss of viability.

Methods

The seeds used in this study came from a bulk collection from several trees growing on surface mine spoil in the vicinity of Middlesboro in southeastern Kentucky. The seeds had been stored dry in a 285-milliliter sealed glass container at 4° C for approximately 18 months before the study began (4). Sample seeds from the top, middle, and bottom of the storage container were mixed and placed in an agitated solution containing 7.18 grams of diammonium phos-

phate $(\text{NH}_4)_2\text{HPO}_4$ fertilizer in 100 milliliters of distilled water at $23 \pm 2^\circ$ C. This simulated a slurry of 680 kilograms of fertilizer to 9,463 liters of water, which is usually used in hydroseeding in southeastern Kentucky. The solution was agitated with a magnetic stirrer. After periods of 1/2, 1, 2, and 3 hours, seed samples were removed and tested for germination. Control seeds were soaked in distilled water. The pH of the distilled water was 4.8 and the fertilizer solution was 8.3.

Seeds were germinated in covered glass petri dishes on a layer of Whatman No. 1 filter paper, four sheets thick, moistened with distilled water (4). A single treatment test consisted of 10 petri dishes containing 20 seeds each for a total of 200. Temperature during the germination period was maintained at

approximately 23° C. Seeds were illuminated with a cool white fluorescent light source at 1.5×10^4 lux. Germination was recorded daily and, for these experiments, was defined as emergence of the radicle. Treatments were compared by computing percent germination and germinative value (5). Germination tests were concluded after 27 days.

Results and Discussion

Soaking paulownia seeds in an aqueous solution of diammonium phosphate fertilizer for periods longer than 1 hour significantly lowered germination (table 1). Germination values for seeds soaked for 1 hour or less were not significantly affected. Percent germination declined in a similar manner. Only 25 percent of the seeds soaked for 3 hours germinated, compared with 74 percent for the 1/2-hour treatment. The negative effect of increasing time in fertilizer solution on germinative value is linear (fig. 1) with $r^2 = 0.92$.

Conclusions

Our results strongly suggest that diammonium phosphate fertilizer used in hydroseeding paulownia is detrimental to the germination of this species. Changing the fertilizer formulation, shortening the immersion time, or applying the seeds and fertilizer separately are possible solutions to the problem.

Table 1.—Effect of soaking the seeds of paulownia in an aqueous solution of diammonium phosphate fertilizer

Treatment	Number of seeds germinated	Mean daily germination	Peak value	Germinative value ¹	Percent germination
H ₂ O Control	139	3.31	4.20	13.90a	69.5
$(\text{NH}_4)_2\text{HPO}_4$ 1/2 hour	148	3.36	4.26	14.331	74.0
$(\text{NH}_4)_2\text{HPO}_4$ 1 hour	134	3.19	3.71	11.83a	67.0
$(\text{NH}_4)_2\text{HPO}_4$ 2 hours	70	1.59	1.92	3.05b	35.0
$(\text{NH}_4)_2\text{HPO}_4$ 3 hours	49	1.19	1.29	1.54b	24.5

¹Germinative values with the same letter are not significantly different from each other at the 0.05 level.

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