EFFECTS OF AQUEOUS EXTRACTS OF HALOGETON TISSUE ON GERMINATION OF SEEDS AND GROWTH OF SEEDLINGS[1]

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The occurrence of growth and germination inhibitors in desert plants is not uncommon. White brittlebrush *(Encelia farinosa)* contains 3 acetyl-6-methoxybenzaldehyde which, when leached from the leaves, retards the establishment of other species in the immediate area (Bonner, 1950). Bennet and Bonner (1953) indicated that toxic extracts might be obtained from mojave desertrue *(Thamnosa montana)*, black greasewood *(Sarcobatus vermiculatus)*, mesquite *(Prosopis juliflora)*, and goldeneye *(Viguiera reticulata)*. Toxic substances leached from guayule *(Parthenium argentatum)* may inhibit the establishment and growth of seedlings of the same species as well as other plants (Bonner and Galston, 1944; Bonner, 1946).

Halogeton *(Halogeton glomeratus)* is an annual weed, which in the past twenty years has infested more than five million acres of desert and semi-desert rangelands in the western states. Field observations in the Big Horn Basin of Wyoming indicate that revegetation following halogeton control is a slow process.

In November 1957, preliminary studies were initiated to determine the effects of soluble halogeton residues on the germination and growth of other plant species.

In the first of a series of greenhouse experiments, a 3 x 3 latin square design was established to determine the effects of halogeton residues on germination of yellow sweetclover *(Melilotus officinalis)* seed. One hundred seeds were placed on white filter paper in plastic trays for germination. The treatment solutions were placed on the filter papers in the germination trays until the paper was saturated, then covered and placed in a greenhouse to germinate at 70 degrees Fahrenheit.

The treatment solutions, outlined in Table 1, were made by taking the designated amount of halogeton, placing it in distilled water, and agitating it for 15

Table 1. Percentage germination of yellow sweetclover seed ten days after treatment with halogeton residues.

	pH of solution	Soluble salts E.C. x 10^{-3}	Percentage germination
Distilled water	6.0	0	23.67
1 gram residue/100 ml. water	8.8	10	0.00
10 grams residue/100 ml. water	8.9	38	0.00

LSD of percentage germination at 0.05 confidence level = 20.81
0.01 confidence level = 48.06

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minutes in a Waring blender and then filtering the resulting solutions.

Halogeton residues at concentrations of one and ten grams per 100 ml. of water completely inhibited the germination of yellow sweetclover seed. Statistical analysis indicated that the degree of inhibition was significant unless a one-in-twenty chance occurred.

In order to obtain more conclusive data, a 4 x 4 latin square design was established using the same experimental materials and techniques. The results of this study are summarized in Table 2

Filtrates obtained from one gram of plant material per 100 ml. of water again completely inhibited germination of yellow sweetclover seed. The difference in inhibitory effects between 0.1 and 0.2 grams was no greater than would be expected through chance alone, but both treatments siginficantly lowered the germination percentage.

FIGURE 1. Germination and growth of barley plants in soil containing halogeton residues. From left to right the pots received residues at the rate of 0, 3.84, and 38.40 pounds per 100 square feet of surface area.

Table 2. Percentage germination of yellow sweetclover seed ten days after treatment with halogeton residues

Grams of residue per 100 ml. tap water	pH of solution	Soluble salts E.C. x 10^{-3}	Percentage germination
0.0	7.3	0.2	59.50
0.1	8.3	1.8	51.75
0.2	8.5	2.8	48.50
1.0	8.7	5.1	0.00

LSD of percentage germination at 0.05 confidence level = 4 91
0.01 confidence level = 7.41

Once it had been determined that halogeton residues limited germination, it became desirable to determine if the halogeton residues added to the soil would limit or reduce the germination and growth of other plants. A 3 x 3 latin square design was established in which ground-up halogeton plants were incorporated into the surface inch of soil within plastic trays containing 50 seeds of the Hiland strain of cultivated barley (*Hordeum vulgare*). Water was added until the soil was at field capacity. Germination was determined at the end of 10 days, and all plants were clipped and weighed at the end of 30 days. The results of this experiment are summarized in Table 3.

The incorporation of halogeton residues into the surface inch of soil at the rate of 38.4 pounds per 100 square feet resulted in a significant reduction in germination amounting to approximately 69 percent (Fig. 1). The reduction in average dry weight of individual plants approached significance at the 0.05 confidence level. Incorporation of halogeton at the rate of 3.84 pounds per 100 square feet of soil surface produced no significant reduction in percentage germination or in dry weight of barley plants.

Summary

Aqueous extracts of halogeton plants inhibited the germination of yellow sweetclover seeds. Extracts obtained from as little as 0.1 gram of plant material per 100 ml. water resulted in a significant reduction in germination amounting to about eight percent.

Incorporation of plant material into the surface inch of soil at the rate of 38.4 pounds per 100 square feet resulted in a significant reduction in the germination of barley seeds amounting to approximately 69 percent. The

Table 3. Percentage germination and weight of barley plants growing in soil containing halogeton residues

Pounds of halogeton per 100 square feet of soil surface	Percentage germination	Average dry weight per plant in grams
0.00	73.33	0.124
3.84	31.33	0.124
38.40	4.67	0.064

LSD of percentage germination at 0.05 confidence level = 43.03
LSD of average dry weight at 0.05 confidence level = 0.066

reduction in dry weight of the surviving plants approached significance at the 0.05 confidence level.

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