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Exploring the Parameters of Paramagnetic Forces

512

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Prior to importing and applying paramagnetic rock to the certified organic vegetable garden I maintain in the Midwest, where soil samples range from 31 to 63 x10^{-6} CGS paramagnetism per 25 grams, I wanted to define parameters of expectation using pot studies in the greenhouse. There are numerous articles and books extolling the potential impact of paramagnetic rock, but there is a dearth of published, replicated experimental results to illustrate the responses of plants to the paramagnetic forces.

To initiate my studies, I was provided with two buckets of fine to coarse rocks sourced from Lake Havasu City, Arizona. The paramagnetic readings of this source averaged 1,250 x10^{-6} CGS paramagnetism per 25 grams of rocks, using a Bartington MS2 System. There were sufficient amounts of fine particles and rock dust to raise the question of whether my rock sample might also have some fertilizer value. I sent a sample to the Country Extension Service for soil testing. The results are tabulated in Table 1 and compared to the existing garden soil. These data indicate that the rock sample would contribute a major fertilizer component.

To work exclusively with the force field, the paramagnetic source material was sequestered in diamagnetic plastic film canisters to eliminate any contribution of fertilizer from the rocks to the experimental plants. I followed this procedure in all experiments. During three winters, I conducted pot studies in the greenhouse. The results have been consistent. I will discuss four experiments, each with different time durations and each addressing different parameters.

In Experiment 1, the question of speed of germination and plant growth within 10 days was evaluated. Canisters filled with paramagnetic rock expressing 0, 500, 1,000, and 1,500 x10^{-6} CGS were buried 1 inch deep in the middle of separate 20-inch flats filled with Scotts Terra-Lite Redi-Earth Peat-Lite Mix (a mixture of horticultural vermiculite and Canadian sphagnum peat moss with no amendments). Three rows of radish seeds (variety, French Breakfast) were planted from end to end across each flat and canister. The rows were a half-inch apart and 39 seeds were planted per row. Within each row, the seeds were also a half-inch apart. The germination date of each seedling was recorded.

More than 95 percent of the seeds germinated within two to four days, and there was no pattern of faster germination over the canisters. The plants in half of each flat were also scored on Day 10 for whole-plant wet weight, length of root, hypocotyl length, cotyledon width, and root wet weight. There was no statistical evidence that seedlings near or over the canisters exhibited preferential growth.

CGS Measurements

Any substance, including soil or rock, that will move toward a magnet is classified as paramagnetic. The CGS of a substance is the measure of its attractant force to a magnet. *CGS* stands for "Centimeter, Grams, Seconds" — and refers to the fraction of one second it takes one gram of a substance, placed one centimeter away from a magnet, to move to the magnet — or alternately, to the weight of a paramagnetic material that will move one centimeter to a magnet in one second.

The critical considerations in this experiment were: (1) the seeds used were fresh and viable; (2) the potting mixture was uniform in all treatments; and (3) the growth period was only 10 days. This is in contrast to other published results where seeds with low viability were used and germinated on paramagnetic rocks or soil (see Gary Wilson, "Seed Germination with Paramagnetic Rock," *Acres U.S.A.*, January 2002; and P.H. Patrick, *et al.*, "Seed Germination with Paramagnetic Rock," *Acres U.S.A.*, March 2003). Viable seeds do not appear to require additional paramagnetic force to germinate. Since oxygen has also been shown to be very paramagnetic, the friability or available aeration of the growth medium is very critical, and the growth medium within experiments must be kept uniform for comparisons.

In Experiment 2, the growth of radish and wheat (variety, Onaga) seedlings was compared in paired-pot plantings. Both pairs had canisters either at the bottom of 8-inch plastic pots or in the middle of the pot. In one pot the canister was empty, and in the other, the canister had rocks measuring 1,500 x10^{-6} CGS. Also compared were Peat-Lite Mix and garden soil. No fertilizer was applied in this experiment. Seeds were placed at 14 equidistant points around the edge of the pot. After germination the seedlings were thinned to one seedling per pot. At day 21, the 14 seedlings were scored for the average weight of the aboveground plant, the average weight of the roots, as well as the average length of the longest leaf and the average length of the roots.

The radish results in Table 2 are expressed as the percent influence of 1,500 x10^{-6} CGS, *i.e.*, the average value for the 0 x10^{-6} CGS plants was divided into the average value for the 1,500 x10^{-6} CGS plants. The conclusions to be drawn are that the group with 1,500 x10^{-6} CGS at the bottom of a pot demonstrated increased plant growth in weight and size by 7 to 36 percent for the measurements taken. The paramagnetic force was stimulating in garden soil and in Peat-Lite mix. If the paramagnetic force was in the middle of the pot, growth promotions were reflected only in the roots, while the aboveground plant parts expressed inhibition. In discussions at the 2001 Acres U.S.A. Conference in Minneapolis, this phenomenon was referred to as a "condenser effect" and is beyond the scope of this discussion except to point out that the responses were consistent in both garden soil and the soilless potting mix.

Table 3 gives the results for wheat. The wheat response was similar to that of radishes. These data indicated that both monocotyledonous and dicotyledonous plants respond similarly to paramagnetic forces.

In Experiment 3, the growth parameters and mineral uptake of radish seedlings were measured. Four-inch plastic pots filled with the soilless potting mix had canisters inserted in the middle, with the lid of the canister level with the surface of the mix. The paramagnetic value in the canisters ranged from 0 to 10,000 x10^{-6} CGS, with the gradient being 0, 100, 200, 300, 500, 1,000, 2,000, 3,000, 5,000, and 10,000 x10^{-6} CGS. To create the highest levels, paramagnetic rock from Nuthin' but Rock, Scarborough, Ontario, was used. Four radish plants were grown per pot. Each pot was fertilized on days 11 and

Table 1. Nutritional Content: Garden Soil vs. Paramagnetic Rock

Element	Brightspot Garden Soil W/2	E/2	Rock from Havasu City
pH	7.1	7.0	7.6
Organic matter	5.00%	5.00%	0.50%
Calcium (ppm)	3652	3784	3451
Magnesium (ppm)	543	485.7	91.6
Nitrogen (ppm)	30	52	31
Phosphorus (ppm)	91	100	7
Potassium (ppm)	500	500	117
Boron (ppm)	2.01	2.35	0.78
Chlorine (ppm)	23	20	20
Copper (ppm)	1.09	0.96	0.2
Iron (ppm)	48	47	4
Manganese (ppm)	13.1	13.2	1.9

Table 2. Influence of Paramagnetism on Radish Growth

	Paramagnetism 10^{-6} CGS		Radishes, n=11-14 Plant	Root	Longest leaf	Root
Parameters	0	1500	(g)	(g)	(cm)	(cm)
Bottom, peat	Pot 1 vs Pot 2		1.192	1.336	1.068	1.085
Bottom, soil	Pot 7 vs Pot 8		1.124	1.099	1.101	1.355
Middle, peat	Pot 3 vs Pot 4		0.808	1.098	0.983	1.075
Middle, soil	Pot 9 vs Pot 10		0.921	1.190	0.919	1.07

Table 3. Influence of Paramagnetism on Wheat Growth

	Paramagnetism 10^{-6} CGS		Wheat, n=11-12 Plant	Root	Longest leaf	Root
Parameters	0	1500	(g)	(g)	(cm)	(cm)

18 with 100 milliliter of a solution of one teaspoon of Miracle-Gro per gallon of water. The plants were sacrificed on day 25.

The results showed that the paramagnetic force did not influence the average length of the longest leaf, but radish

see next page

Figure 1. Experiment 3: Growth Measurements

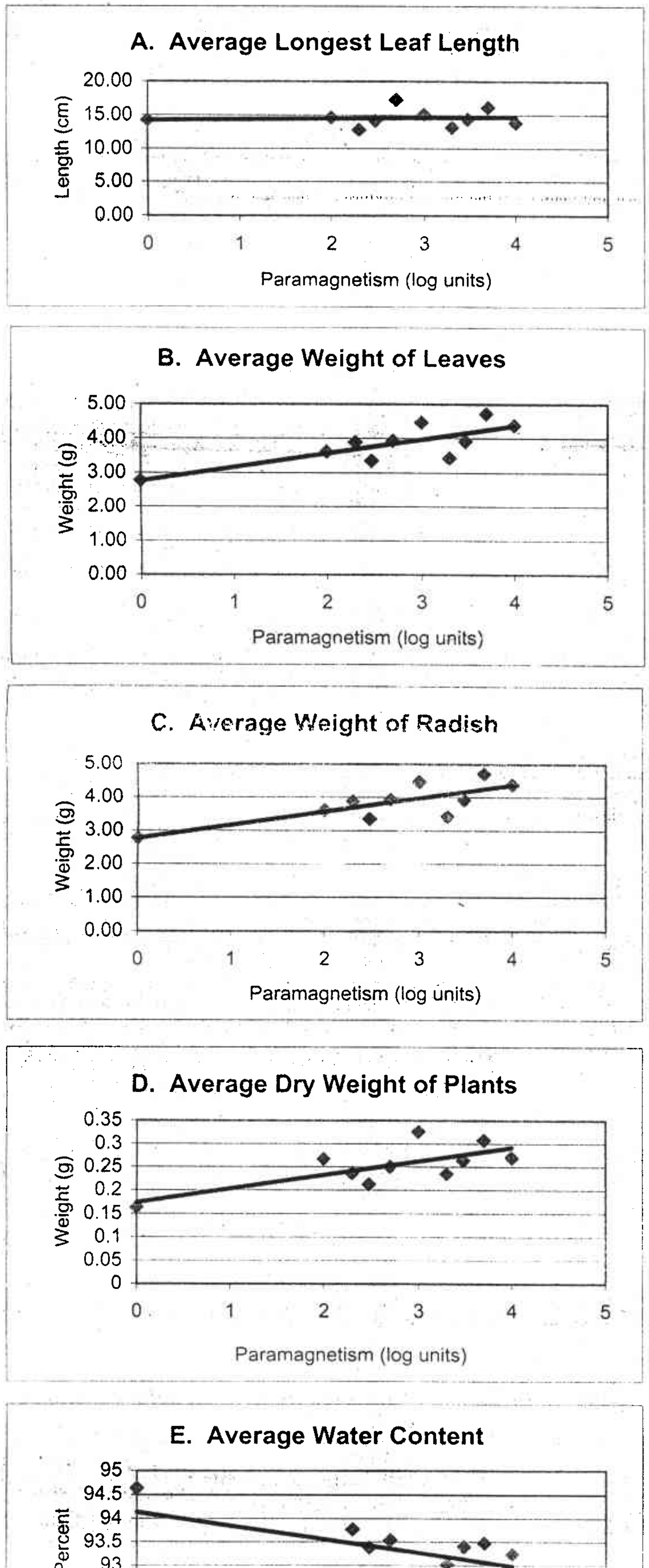
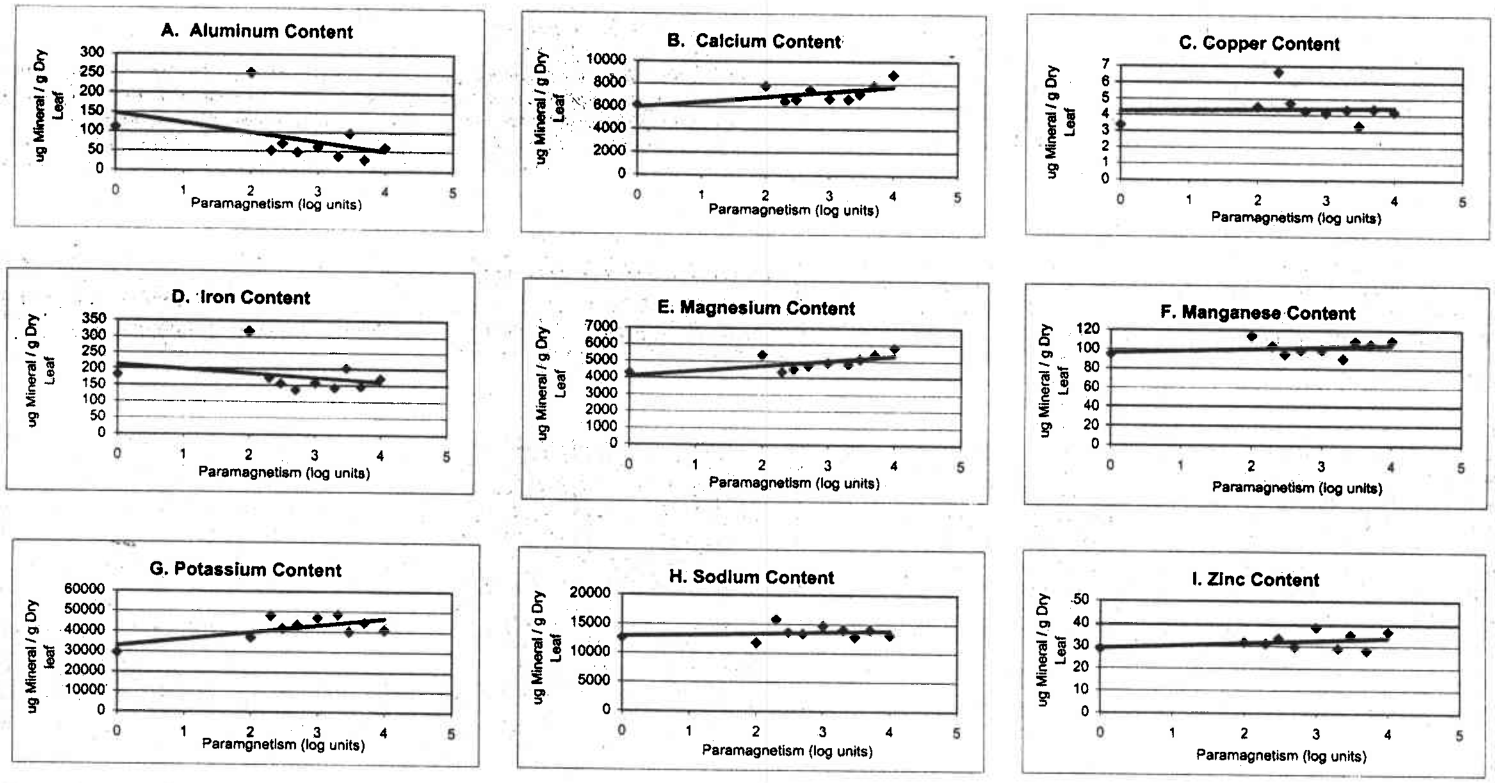


Figure 2. Experiment 3: Mineral Content



Exploring . . .

from page 19

leaves form a rosette and so are less likely to show major length differences (see Figure 1A). However, the average total weight of the leaves increased (see Figure 1B). The average weight of the radish and root increased (see Figure 1C). The average dry weight of the total plants increased (see Figure 1D), and conversely, the average water content was less in the plants grown in the presence of a paramagnetic force field (see Figure 1E).

The total plant mass of each pot was dried, pulverized, and analyzed for mineral content: Al, Ca, Cu, Fe, K, Mg, Mn, Na and Zn. The results are mineral-specific rather than a uniform pattern. The average aluminum content was lower than control in all treatments except at 100 $\times 10^{-6}$ CGS (see Figure 2A). The average calcium content was increased with paramagnetism (see Figure 2B). For copper, the average response was higher than control with a spike at 200 $\times 10^{-6}$ CGS (see Figure 2C). The average iron content was not increased except at 100 $\times 10^{-6}$ CGS (see Figure 2D). The average magnesium content tended to be higher than control, with a spike at 100 $\times 10^{-6}$ CGS and then a gradual increase to 10,000 $\times 10^{-6}$ CGS (see Figure 2E). The manganese content average was equal to the control or greater than control, with a spike at 100 $\times 10^{-6}$ CGS (see Figure 2F). The average potassium content also increased, but did not exceed the response level of 200 $\times 10^{-6}$ CGS (see Figure 2G). The sodium content was not markedly above control, except for the peak at 200 $\times 10^{-6}$ CGS (see Figure 2H). The average zinc content was equal to control or higher (see Figure 2I).

In general, mineral uptake was enhanced in the presence of a paramagnetic force field. The two exceptions were aluminum, with decreased uptake, and iron uptake, which appeared unaffected — although both of these mineral had distinctive spikes at 100 $\times 10^{-6}$ CGS. The other minerals tended to have positive responses, but these too had peak responses at 100 or 200 $\times 10^{-6}$ CGS. Magnesium and calcium had spikes at 100 $\times 10^{-6}$ CGS, but expressed a gradient effect with increased levels of paramagnetism. Manganese had its maximum response at 100 $\times 10^{-6}$ CGS. Copper, potassium and sodium expressed their highest uptake at 200 $\times 10^{-6}$ CGS. Zinc did not show any marked peak. These data may indicate maximum thresholds of influence within this experimental context.

In Experiment 4, the influence of fertilizer on the plant responses in the presence of a paramagnetic force field was measured. Eight-inch plastic pots were filled with the soilless Peat-Lite mix and canisters with paramagnetic rock were buried on the bottom. The paramagnetism ranged from 0 to 5,000 $\times 10^{-6}$ CGS, in increments of 1,250. Paired treatments were set up, with half receiving fertilizer and the other half receiving only water. The fertilized group was watered with 300 milliliters of a solution of one teaspoon of Miracle-Gro per gallon of water on days 11, 18, 25, and 32. Eight radish plants were grown per pot. The plants were sacrificed at day 35.

The fertilization with Miracle-Gro would not appear to have paramagnetic implications, because 25 milliliters of the municipal water used showed a diamagnetic reading of -2.15 $\times 10^{-6}$ CGS. The solution with one teaspoon of Miracle-Gro per gallon of water had a reading of -2.00 $\times 10^{-6}$ CGS.

The results shown in Figure 3 indicate that without fertilization, the paramagnetic force stimulated growth in a gradient and exceeded the growth of control for leaf weight (see Figure 3A), radish (root) weight (see Figure 3B), and average dry weight per plant (see Figure 3C). With the application of fertilizer, the plants were larger, and the control was equal to the plants grown with a force field. The fertilizer also tended to eliminate the paramagnetic gradient response.

The data from these four experiments emphasize the importance of using viable seeds, and managing the fertility and friability of the soil. Friable soils with adequate nutrients would not appear to be candidates for the application of paramagnetic rock to achieve extra growth from the force field. Well-nurtured plants have growth rates that would probably mask any influences from the force field. It would appear, however, that soils with less-than-adequate nutrients would benefit from an application of paramagnetic rock that contributes a major fertilizer component.

A soil with high organic matter is likely to be sufficiently friable to allow highly paramagnetic molecules of oxygen to permeate the active root zone. Soils high in organic matter may well have adequate minerals to create sufficient magnetic susceptibility to provide sustenance for the active soil biota, as well. The Peat-Lite soilless mix used in these experiments was not sterile, neither was it inoculated with soil biota. However, the results in Experiment 2 indicate that similar growth enhancement was obtained from the force field in soil or in a soilless mix. The increased dry weight accumulation stimulated by the paramagnetic force in Experiment 4 was negated with fertilizer application.

The use of highly paramagnetic growth media will continue to find application to break the dormancy of seeds. This would be particularly advantageous for seed conservation and long-term storage of rare and heirloom plant genetic resources.

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Figure 3. Experiment 4: Influence of Fertilizer