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Lead Absorption From Soil Into Legumes

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ABSTRACT — There is evidence that lead is taken up from the soil into legumes and accumulated in the leaves of beans and peanuts which were examined in this study.

While studying the porphyrine accumulation in root nodules of legumes it was found that lead in the soil could increase the production of the cytochrome component. The present study is a suggestion to take a closer look at the absorption of lead into legumes. A symposium on "Air Quality and Lead" showed that the soil will absorb lead near highways, but that the accumulation of lead in garden vegetables seems to be a surface matter only. Leguminous plants, however, seem to have a definite absorption into the whole plants, as shown in this study.

Preparation of specimens

Beans (Kentucky Wonder) and peanuts were inoculated with "Nitragen" and sprouted in Petri dishes, and the seedlings were planted into a 50:50 mixture of soil and terralite. The mixture contained less than 5 micrograms of lead per gram dry weight. After one month of growth, a 1% lead acetate solution was added to half the

TABLE 1

	Days Time	Soil less than 5μg	820 μg/g Pb/g soil
Bean whole plant.....	8	29	160
Bean roots	30	68	665
Bean leaves	3	60	350
Bean leaves	30	60	1,070
Peanuts leaves	30	N.D.	305

plants on successive days to a total of approximately 200 ml/kg dry soil.

Some plants were removed from the soil, washed, air dried, dried further in an oven at 100° C for one hour, and subsequently powderized either whole or the separate parts. Samples of 1-2 grams were digested with 10 ml concentrated nitric acid at room temperature for 24 hours, heated, diluted to about 30 ml, and heated again.

The cloudy solution was filtered hot through glass wool — which had been treated equally with hot nitric acid — and washed with boiling distilled water to extract any leadchloride formed from naturally occurring chlorides. By adding ammonia the pH was adjusted to 5 and the solution made up to 100 ml.

The concentration of lead was determined in a Perkins-Elmer Model 303 Atomic Absorption Spectrometer at a wave-length of 2,170 angstrom. The results are shown in Table 1. While the beans did not grow as well in leaded soil as the normal ones, peanuts did not show any inhibitions of growth. The beans also showed spotty discoloration.

In further experiments beans and peanuts were germinated and transplanted directly into leaded soil containing 820 microgram/gram of dry soil. Control experiments were done in specialized soil: vermiculite mixture Pb not detectable. Again, while the beans showed poor growth, the peanut plants grew as well in leaded soil as in soil without lead. These results are show in Table 2.

It appears that lead is obsorbed into the plants and enriched in the leaves. One pod of beans obtained did not show any lead, but this is considered inconclusive. This experiment should be repeated on a larger scale.

If the absorption of lead into leaves of legumes is much more pronounced than absorptions into other plants, and if the above findings are true for all legumes, this may present a major threat to forage crops such as alfalfa or clover.

TABLE 2

	Time Month	"Clean" soil	Pb-soil 820 μg/g
Bean leaves	1	N.D.*	less than 50
Bean leaves	2	N.D.	5,000
Bean whole plant.....	1	N.D.	1,150
Bean whole plant.....	2	N.D.	2,040
Peanuts leaves	1	N.D.	305
Peanuts leaves	3	N.D.	10,000
Peanuts whole plant ...	1		850
Peanuts whole plant ...	2		1,150

* N.D.=amount not detectable.

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Most of the plants studied in this experiment were grown in the plant room of Northwestern College under "Grow Lite." Some were raised in window sills at various times of the year.

* MARIE H. BERG, Ph.D., of the Mathematics and Science department of Metropolitan State Junior College, Minneapolis, has been engaged for many years in the research from which this paper was developed.