Letters

Nuclear Tests

I cannot conceal my disappointment, even shame, on reading the pious platitudes of our Council's Resolution on Control of Nuclear Weapons Tests, printed in the issue of 16 January [*Science* **129**, 137 (1959)]. One might rather have expected such a resolution from an association of scientific civil servants, too terrified of losing their jobs to risk offending Dulles and the Atomic Energy Commission. An embarrassed silence would have been preferable to this type of sickening hypocrisy.

Instead of emitting "profound hope that the Geneva Conference negotiations will prove successful," the Council might well have told the world in a clear, straightforward way (i) whether they consider that nuclear bomb test explosions constitute a probable danger to the future of our species; (ii) whether they favor discontinuance of such explosions (that is, *yes* or *no*); (iii) whether they are alarmed at the present situation in which two armed, cynical, irresponsible, and dishonest giants are daily threatening each other and the rest of the world with total destruction; and (iv) how the international scientific community can bring pressure to bear on Tweedledum and Tweedledee to restore calmness and sanity where it is most needed.

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Beneficiation of Soils Contaminated by Strontium-90

I have read with surprise and concern W. F. Libby's report [*Science* **128**, 1134 (1958)] on his experiments which were made, as he says, to test two proposals: (i) that the addition of sulfates to contaminated soils might be helpful in making strontium unavailable for plant nutrition, and (ii) that potassium might have a considerable beneficial effect with respect to absorption of radiostrontium.

I will attempt to justify my surprise on purely technical grounds, for what Libby refers to in his report are not experiments but, at best, "high spot tests," which could not, on any grounds, allow one to arrive at valid conclusions.

The soil is such a complex system that it must be fully characterized before one can undertake to do anything with it. To say that the soil used was taken from a garden in Washington, D.C., and that it had an exchange capacity of 32 milliequivalents per 100 g is utterly useless, if this information was intended to help the scientific reader interpret the sig-

nificance of the pot tests. Since we should be interested in facts, I would have preferred to see a minimum of basic information on: (i) the ion components of the exchange capacity, particularly K^+, Ca^{+2}, NH_4^+, and Na^+; (ii) the ease of availability of the "native potassium," both by actual chemical tests and by plant growth tests, and (iii) an analysis of the soluble and insoluble sulfates.

This information would have contributed greatly to understanding the significance of Libby's initial additions of the potassium and strontium salts in amounts of about 1 percent of the total exchange capacity of the soil mass used per pot. The lack of this type of information is perhaps understandable, for it still appears to be the exclusive property of that breed of men known as soil scientists.

The tests themselves were faulty, because their design ignored some basic characteristics of the experimental material and disregarded some elementary principles of experimentation.

The soil cannot be treated as if it were a chemical reagent, for, above all, it is a complex entity with its essential characteristics of variability and a sensitive ability to change with the treatments given, and with environment. To control this inherent variation, an essential part of any experimentation with a soil is replication—not just duplication, as is customarily done in a simple titration, but, say, from three to five repetitions for each treatment. Moreover, these treatments should be laid out in accordance with a design that will strengthen the scientist's chances of beating nature!

Libby's claims, I would assume, must be based on a subconscious acceptance of the findings obtained by Peech, Bradfield, Reitemier and others. His data could not support any of his conclusions.

The use of the ABCD type of tests to arrive at conclusions which have a direct bearing on the health of all mankind should be a question of great concern to all responsible people. I was delighted to read front-page newspaper reports about "Dr. Libby's solution of Sr^{90} fallout by adding to the soil potassium fertilizers," only to find out later, with great disappointment, that the claims were totally unwarranted. But, alas, public opinion has been given one more pill of relief.

L. A. Romo

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The recent report by W. F. Libby demonstrates a surprising lack of information on matters that are relatively well known to biologists. It has been known for at least a quarter of a century that potassium in the soil reduces the uptake of calcium, and, since calcium and strontium are so closely related, it would seem obvious that added potassium would reduce strontium uptake from soil. See Fig. 1, which is slightly modified from one that was published in 1933.

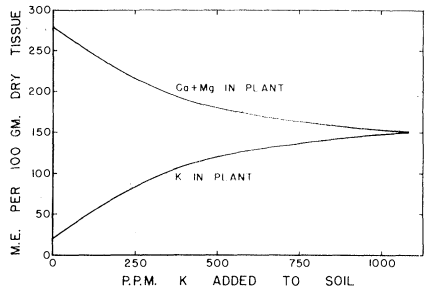

Fig. 1. Ion content of tomato plants as a function of potassium added to soil. [From data of D. R. Hoagland and J. C. Martin, *Soil Sci.* **36**, 1 (1933); redrawn by D. R. Hoagland.]

Would it be too much to suggest that the Atomic Energy Commissioners, when confronted with botanical problems, might employ a botanist?

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I have read with disappointment L. A. Romo's criticism of my article, "Beneficiation of soils contaminated with strontium-90: beneficial effects of potassium." I know well how incomplete the work is, but I hope it has more scientific value than Romo finds in it. Perhaps its best value will be to encourage further research into what is a very important practical problem. The extensive research on radioactive fallout which has been conducted during the past years shows that the type of work I tried to do is urgently needed.

Thimann and Stowe are correct in questioning my knowledge of botany, but I hasten to assure them that the Atomic Energy Commission does employ very capable botanists. It is true, of course, that the effect of potassium on calcium uptake by plants has long been known. The corresponding effect on strontium has not been established so firmly, however, especially for the very low concentrations resulting from radioactive fallout on acid soils.

I hope the work has more merit than the tone of these letters indicates. The problem is a very important one for civilian defense, and it was only after failing to persuade professionals to undertake it that I made this attempt.

I hope Romo and Thimann and Stowe will turn to and do a better job for us all.

W. F. Libby

Atomic Energy Commission,
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