In view of this variation, and of the close agreement between the sex ratios of the two groups in our study, we conclude that, for the rat at least, the sex ratio is not affected by the feeding of base or acid.

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THE EFFECTS OF THALLIUM SULFATE UPON SOILS

QUESTION has lately been raised concerning the ultimate effects, upon the soil, of the thallium compounds used for rodent control. S. C. Brooks[1] has warned land owners of the possibility that the soil might be sterilized by this practise. Obviously, such a problem merits investigation. The writer has developed critical methods during studies on weed control and is preparing a detailed report on tests with thallous sulfate. Meanwhile, he presents the following summary of pertinent results.

Using four California soils, the writer studied the initial toxicity, the decrease of toxicity with time and cropping, the saturation capacity of the soils and the effects of thallium-coated grain upon adjacent plants. Oat seedlings used as indicator plants were harvested 30 days after planting in the greenhouse tests.

In equimolecular concentrations, thallous sulfate proved many times as toxic as arsenic trioxide and sodium chlorate. Whereas toxicity of the latter soil sterilants decreased with successive cropping, that of thallous sulfate remained unchanged through three such treatments.

Thallium toxicity was tested through a range of 25 ppm to 2,000 ppm in the soil solution. It proved greatest in soils of low fertility but could not be correlated with soil type or water-holding capacity. The chemical was strongly fixed in all soils, the saturation capacity of Yolo clay being about 10,000 ppm on a dry weight basis. Leaching with 200 cm of distilled water had practically no effect on the location or toxicity of thallous sulfate in the soil.

Thallous sulfate is an extremely effective soil sterilant, it is strongly fixed and it resists leaching. Although these facts explain Brooks' observations and would seem to justify his warning, their aspect is changed by quantitative studies. Thallium-treated "potted" (hulled) barley had practically no effect upon germination or growth of oats planted in the same soil and spaced within ½ centimeter of the barley grains. When the spacing was decreased to ¼ centimeter, growth was reduced. Except where the dosage was excessive, oat seedlings were unaffected by the application of treated barley to the soil, followed by irrigation.

[1] S. C. Brooks, "Thallium Poisoning and Soil Fertility," SCIENCE, 75: 105–106, 1932.

Thallium-treated grain also affected vegetation in a pasture area very little. The heaviest application, equivalent to 27 pounds of thallous sulfate per acre, reduced growth less than 50 per cent.

In concentrations of 100 ppm or more (on a dry weight basis) thallous sulfate should, apparently, be fully toxic in most soils. At this rate, about 30 pounds would be required to sterilize an acre inch.

Calculations on the area sterilized by the grains comprising a squirrel bait (approximately 20 grams of poisoned grain) show that over 100,000 baits would be required to cover an acre. This is equivalent to 5,000 pounds of poisoned grain bearing 50 pounds of thallous sulfate and might sterilize the top 1½ inches of soil. Under natural conditions, however, the chemical would be fixed in a much shallower layer. The baits, if taken, would be distributed through the top four feet of soil and would have little sterilizing effect.

The disparity between these figures and the amounts used in field practise is striking. As shown by a brief survey of ground-squirrel control in California, the average initial dosage of poisoned grain bearing one per cent. Tl_2SO_4 is about 1/3 pound per acre; later applications are lighter. In one county the dosage has decreased to 1/35 of a pound in five years. The success of this material should permit similar reductions in other regions, so that the amount of chemical becomes totally insignificant as far as soil sterilization is concerned.

The writer observed no loss of fertility in range lands successfully treated for five successive years. The only denuded areas found were the open burrows, fresh mounds and beaten trails of squirrels in untreated fields. Regardless of other objections to thallium compounds in rodent control, the possibility of losing agriculturally valuable land through sterilization seems remote.

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