cation of the arsenate and the time when crabgrass seed usually germinates. This may have given time for the arsenate to become soluble. In a few Green Section tests at the Arlington Turf Garden and elsewhere, some retardation of germination has been noted in areas receiving as little as 5 pounds of arsenate of lead to 1,000 square feet, but in most cases the results have been in accord with the Bingley observations.

### A Distinctive Color for Arsenates

The Paris green with which we used to kill potato beetles had a distinctive color and could not be mistaken for flour or sugar. Lead and calcium arsenate, however, look too much like flour or sugar to make them safe to have about the house. In fact, many cases of poisoning have been reported because of error in the use of the arsenate. Three states, Louisiana, South Carolina, and Tennessee, have legislation requiring that poisons which resemble foodstuffs or any ingredient of foodstuffs, shall be stained. Through the voluntary action of the manufacturing chemists' association such coloring will be made general, as the association has announced that both lead and calcium arsenate will be colored pink. This action is to be commended, as it will help to decrease deaths due to mistakes in the identity of the poison. The color will not interfere with the effectiveness of the poison.

### Sodium Arsenite and Sodium Chlorate Render Soils Sterile

Perhaps there is no part of the United States in which there has been more interest in chemical weed killers than in the West. Chemicals are used extensively on the Pacific Coast to kill weeds in cultivated fields but the problem of sterilizing soil so completely that vegetation may be excluded from tennis courts, drives, walks, and waste places is of special interest. Crafts in California made a study of the relative toxicity of sodium arsenite and sodium chlorate in four different California soils. The reports on this work appeared in Hilgardia. The soils varied from a heavy clay loam and adobe loam to a sandy loam and a fine sandy loam, and the results varied considerably in the different soils.

Varying proportions of arsenite were added to the soils and oats were planted to indicate the degree of sterility. Taking a growth of one gram in weight for 10 oat plants in 30 days as indication that the soil was practically sterile, it was found that the quantity of arsenite required

to produce this result varied from 500 parts per million in Yolo clay loam to only 60 parts per million in Fresno sandy loam. Stockton adobe clay needed only 100 parts per million while Columbia fine sandy loam took 240 parts per million.

This great variation shows how impossible it is to give broad advice that will apply to all soil types. It may also explain many anomalies in the results of field work. The power of these soils to fix arsenic, the depth of penetration of the arsenic, and the rapidity of leaching, also varied with the different soils. Expressed in terms of practice, the information seemed to show that 7 pounds of sodium arsenite to 1,000 square feet were as effective on Fresno sandy loam as 28 pounds on Yolo clay loam. The depth of penetration of the arsenic varied with the soil and this fact influences the value of the treatment for deep-rooted plants. An application of 14 pounds to 1,000 square feet on Fresno sandy loam penetrated 12 inches, with a total rainfall of 5 inches, while in the Yolo soil, under similar conditions, the penetration was only 2 inches. Loss of toxicity with time also varied, being greatest in Yolo soil and least in the Fresno sandy loam.

The toxicity of sodium chlorate also varied with the soil, but not in the same order as the arsenite. It was highest in the Stockton adobe clay and lowest in the Yolo clay loam. Toxicity was higher when the chlorate was mixed with moist soil than with dry soil. The chlorate could be completely washed out of sterile soil by a liberal use of irrigation water.

In later work by Crafts and Cleary combinations of various chemicals were used and it was found that some neutralized each other in one soil while in another the combination had greater killing power than either alone. Thus arsenic and borax were antagonistic in Yolo clay, while in Fresno loam the effect of one was added to that of the other. Arsenic and chlorate mixed were additive in effect in all soils and form a very useful mixture. Although borax and sodium chlorate are antagonistic, this antagonism could be reduced and the advantages of the combination retained by using the lowest effective dosage of chlorate and adding enough borax to complete the destruction of the vegetation. This combination is practically non-poisonous and the borax reduces the fire hazard, which is always present where chlorate is used. The borax also has a residual effect and decreases the chance of reinfestation by seedlings.