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Forest Nursery Seedlings Subject to Arsenical Injury in Some Soils

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The unprecedented demand for forest-tree seedlings to meet the requirements for such government agencies as the Tennessee Valley Authority, the Soil Erosion Service, and the Forest Service in carrying out their extensive planting programs has necessitated the enlargement of existing forest nurseries and the establishment of many new ones. In selecting new areas for nursery sites, it sometimes becomes necessary to include grasslands, or open woodlands in which grass occurs. Frequently such areas are infested with white grubs, the young of May beetles. Consequently, when seed beds are prepared on new ground with precaution, such as steam sterilization, fumigation, etc., being taken to free the soil of such pests, severe injury is liable to result and often is quite noticeable the first season. This is particularly true where the nursery is established the year following a heavy flight of beetles, since the grubs are known to be voracious feeders during their second season, and especially for the typical three-year forms, which are abundant over most of the northern sections of the country. In the extreme North the life cycle is lengthened to four years, and in the South, with some species, it is shortened to two years or less.

Control of grubs throughout the season is possible by means of soil fumigants, but costs are prohibitive, especially under conditions where the grubs are present in large numbers. For this season, in cooperation with the Forest Service, a series of soil-poisoning treatments was arranged to determine the effectiveness of certain chemicals in protecting seedlings from these pests. It was believed that such treatments would be practical inasmuch as a single application might suffice for one or more seasons, and the cost thereof, in the form of materials and labor, would be small. These tests have been in progress since the spring of 1930 in the federal nursery in Nebraska¹ and since 1932 in the three state nurseries in the Carolinas. At the time the tests were begun, little information was available relative to the effect of various chemicals on germinating and first-year seedlings. Inasmuch as lead arsenate was used so successfully against the Japanese beetle in freeing the soil from their destructive grubs, this chemical was among the first used in the present tests for the control of larvae of the May beetles. Such procedure also was in conformity with recommendations frequently made for the control of white grubs in forest-nursery practice. However, these recommendations for the control of the Japanese beetle grubs

¹ The tests in Nebraska have been conducted under the supervision of L.G. Baumhofer of this Bureau and those in the Carolinas by the writer, assisted by H.R. Johnston.

were for the treatment of mature established plants and no information was available on the effect of the treatment on the germination and development of forest-nursery seedlings.

Arsenic in the form of acid lead arsenate and crude white arsenic was used, but most of the tests were made with the former chemical. The latter was used only during the initial application in the Nebraska nursery. In general the arsenic was applied by mixing it with sand or manure before working it into the soil to a depth ranging from 2 to 10 inches in the various experimental beds. This was done in the early spring just prior to planting. Beds were treated which were subsequently sown or transplanted to such species as pine, red cedar, locust, and walnut.

The soils in all four nurseries consist mainly of light sandy loams. Those in the Coastal Plain region of the Carolinas are somewhat acid, ranging in pH value from 4.8 to 5.6. That in the Sandhill region in Nebraska is nearly neutral, being close to 7.

Although no definite statements can be made or conclusions drawn until the tests have been completed, it is believed that a brief preliminary announcement should be made, setting forth some of the more important indications of results, before the spring planting season begins; it is believed that this information will be helpful to foresters and others interested in the production of seedlings.

- (a) Arsenic, in the form of lead arsenate or white arsenic, should not be used until more experimental work is done, because severe injury has resulted to seedling and transplant stock, such as pine, locust, walnut, and red cedar.
- (b) Arsenic appears to affect seriously germination and to stunt the growth of plants.
- (c) The degree of injury varies with the species, age of the plant, dosage of the chemical, and the soil.
- (d) In some soils arsenical injury may not become apparent until after the first season and may persist for a number of years.