

Seedlings grew second best in plots using soil obtained from the medium rate of limestone and phosphate treatments. The poorest growth was obtained in soil from plots which had received the medium and high rates of phosphate without limestone. These latter soils were highly acid; and the seedlings were obviously affected by copper toxicity, as symptoms of iron chlorosis were apparent in the leaves and the plants were severely stunted. When pH was increased with calcium carbonate, seedling growth was greatly improved. The feeder root yields were very closely related to the total dry matter production from the seedlings regardless of treatment.

There did not appear to be any detrimental effects of phosphate on root growth in this experiment. Growth was retarded at low pH levels probably because of toxic levels of copper, and in the non-phosphated soils, by an apparent shortage of phosphorus. This experiment clearly demonstrated that the soil which received heavy rates of phosphate in combination with limestone in the field was no longer toxic to the growth of citrus tree feeder roots.

Experiment P-II.—The effects of phosphate and other chemicals on growth and chemical composition of rough lemon seedlings and related soil pH of certain selected treatments are reported in Table 12. The major differences in growth were caused by the application of ammonia-containing phosphate compounds to the grove soil high in copper and by copper applied preplant in combination with periodic applications of ordinary superphosphate. Detrimental effects of two treatments, ammonia-containing phosphate compounds applied to soils high in copper and superphosphate in combination with a high amount of copper (Treatment 45), were apparent very early in the course of the experiment.

The ammonia-containing phosphate compounds severely retarded growth in the grove soil but not in the virgin soil. These compounds resulted in lower soil pH levels, especially in the subsoil, than did phosphate compounds not containing ammonia. A comparison of Treatments 44 and 45 indicated that 200 pounds copper per acre mixed preplant resulted in normal growth of seedlings; however, when ordinary superphosphate was applied periodically in addition to the copper, seedlings were severely stunted and chlorotic, indicating copper toxicity. These treatments—13, 14, 15, and 45—illustrate the effects of acidifying materials on mobilization of copper and consequent copper tox-