THE EFFECT OF PARTICLE SIZE OF COPPER- AND ZINC-SOURCE MATERIALS AND OF EXCESSIVE PHOSPHATES UPON THE SOLUBILITY OF COPPER AND ZINC IN A NORFOLK FINE SAND

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Some attention has been given recently to the importance of zinc and copper in citrus nutrition, and their use either in sprays or as soil applications in regular production programs is becoming more common each year. In Florida, spraying seems to be more satisfactory than soil applications in correcting copper and zinc deficiencies and in maintaining high production levels. Peech (4) found that three Norfolk fine sands held a high proportion of ordinary applications of zinc and copper against an extraction with a normal NaCl solution. The amounts retained were considered “fixed” in nonexchangeable forms. The author (1) has found that several consecutive salt extractions will continue to remove much more copper than is soluble in distilled water. Peech (4) showed that the amount of copper or zinc retained against a single salt extraction is related to soil pH. The higher the soil reaction the greater was the retention. Also, at any given pH more copper than zinc is held. Recent studies (2) show that each increment increase in the amount applied is less strongly held than the previous addition. As the soil is more nearly saturated with zinc or copper, a greater proportion of that added is more easily replaceable. In addition, the retention of these elements by Norfolk sands or similar soils is affected by time. The longer a copper or zinc solution remains in contact with the soil, at least up to 48 hours, the more strongly it will be held against the replacing action of a salt extraction.

It has been shown by Peech (4) that soil phosphates are not responsible for zinc or copper fixation in Norfolk fine sand and a recent survey study (3) shows this to be true for soils in general in the citrus areas of Florida. Mucks, peats, and sandy soils alike strongly adsorbed zinc and copper regardless of their phosphate content or of additions of superphosphate within ordinary limits. These soils have a common property which should be emphasized. As far as their chemistry is concerned, they may be considered as organic in nature. The adsorptive or exchange property of the sandy soils as well as of the mucks and peats is due largely to the organic matter content. The amount of mineral clay present is ordinarily very small. In this light, the strong adsorption of zinc and copper by these sands as well as by the nominally organic soils is not so surprising.

It has been pointed out (4) that even though copper is more strongly held than zinc in a Norfolk fine sand, it is not held in such quantities as to preclude soil application. The experiments reported here were planned to determine the effect of particle or crystal size of the sulfates of zinc and copper together with different rates of superphosphate application on copper and zinc solubilities in a Norfolk fine sand. In addition to this soil, two Norfolk fine sand grove soil samples were used to test the effect of particle size. One was taken from a plot which had received heavy superphosphate applications and a plot which had received heavy superphosphate for several years. The results obtained from these soils were not significantly different. For the sake of brevity only those for the virgin soil are presented here.

PROCEDURE

Large bulk samples of surface and subsurface soil from the field, screened through an aluminum screen and mixed. Sufficient CaCO₃ was added to the soil to bring it to pH 5.75 after 2 days equilibration. This is approximately the same soil reaction as ordinarily found in grove soils. The subsoil was packed uniformly into the pots. The amount of mineral clay present is ordinarily very small. In this light, the strong adsorption of zinc and copper by these sands as well as by the nominally organic soils is not so surprising.

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