

INDIANA SOILS CONTAINING AN EXCESS OF SOLUBLE SALTS.

S. D. CONNER

The usual procedure when making a laboratory examination of an Indiana soil is to test for a probable deficiency of lime, organic matter or plant food elements. There are, however, some soils from the humid section that have too much rather than too little plant food and soluble salts. The bulk of such soils are peat, muck or black sand soils that were formed in poorly drained sections. The only clay or loam soils in humid regions which have excess soluble salts are very local in area and are formed by artificial rather than natural causes.

The black soils high in soluble salts are of two general types. One type contains relatively small amounts of soluble salts of a highly toxic nature. An example of this type is the acid black sand of the Wanatah experiment field where the soluble matter is largely aluminum nitrate, a salt very toxic to the roots of agricultural crops. Results of experiments on this soil are published in Bulletin 170, Purdue Agricultural Experiment Station.

Another type of the black soils under discussion contains relatively small amounts of toxic salts but very high concentration of salts of low toxicity. One such soil was sent to the Experiment Station laboratory from Starke County. The samples were taken from an onion field on muck soil in September, 1913. Where the onions were dying the soil contained .44% nitrates and 1.2% soluble salts. Where the onions were doing well the soil contained .10% nitrates and only .45% soluble salts. Another case where soluble salts seemed to be the cause of injury to onions was reported from muck soil in Noble County in July, 1916. Samples taken from the part of the field where the onions were dying contained .50% nitrates and 1.12% soluble salts, while the soil from the part of the field where the onions were still good contained .17% nitrates and .57% soluble salts.

Quite a number of cases have been reported where both onions and corn on muck soil seemed to be failing or were entirely destroyed because of a high concentration of soluble salts. Analysis of water extracts of such soils show that the soluble salt is composed largely of calcium and nitric acid. The occurrence of this salt in such soil is not hard to explain as the soils contain large amount of nitrogenous organic matter and calcium. During the warm weather of summer nitrification is very active and calcium nitrate is formed in great quantities. As the soil moisture evaporates this salt together with any other soluble matter is carried to the surface and deposited in such quantities that the salts act in the same manner as the alkali salts in Western soils. Calcium nitrate is an excellent fertilizer for thin lands but

in these soils it is a positive detriment. While calcium nitrate is perhaps one of the main factors in producing crop injury, it is not the only one. Given a mixture of salts of varying degrees of toxicity and mixed in different proportions it is, of course, impossible to say just what causes the injury.

Areas containing excess soluble salts in Indiana clay or loam soils have been found only where refuse matter has been dumped or in locations where old stables stood. A farmer near Warren reported a spot in a field where crops had failed for five years on the site of an old stable. Samples of soil were taken at various depths and analyzed. The soil at 0 to 6 inches had .1% nitrates, .85% water soluble potash and 2.54% total soluble matter. At a depth of 24 to 30 inches there was .012% nitrates, .44% water soluble potash and 1.33% total soluble salts, the trouble in this case being without doubt caused by an excess of potash and other soluble salts. This and similar cases illustrate very well just how extensive the leaching of manure may be, and how important it is to prevent such loss by providing concrete or some other kind of water-tight floor in the stable. The soil on this spot to a depth of at least 30 inches had a fertilizer value equal to manure five years after the stable had been removed.