

THE INJURIOUS EFFECT OF BORAX IN FERTILIZERS ON CORN.

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About June 1, 1917, the Experiment Station was notified that in a large number of fields near Francesville the young growing corn had lost its green color and had turned white or had entirely wilted down. Together with Mr. O. S. Roberts of the State Chemist's Department, I visited the cornfields on June 5th. We found a number of fields where the corn was entirely white. The damage was all on land where fertilizer was used, and by far the greatest damage was caused where fertilizer containing 5 per cent of potash and 5 per cent of available phosphoric acid had been used. There appeared to be no question about the fertilizer having caused the damage as in a number of fields one or more rows of unfertilized corn remained good alongside of badly damaged fertilized corn. In some fields several amounts of fertilizer had been used and the damage was greatest where the largest amounts of fertilizer were used. The fertilizer injured the corn by retarding germination, also by turning the corn white and holding it back so that insect damage was greater where the corn was fertilized, and in some cases the corn had even been killed. Some of the corn which was not damaged very badly was said by the farmers to be looking better than it had a few days before. Later reports indicate that some of the white corn recovered almost entirely while other fields had to be replanted, while still other fields remained more or less damaged even to time of harvest.

On September 24th another visit was made to the damaged fields. Some of the corn had been permanently damaged probably seventy per cent., other fields much less and in some cases there was no apparent damage. The damage seemed to vary on different types of soil, some of the worst was on light sandy and some on peaty soils. As a rule there was not so much damage on heavier soils. Corn fertilizer in Indiana is generally drilled along the row where the corn is checked or drilled. Fifty pounds of the 5-5 fertilizer per acre seldom caused much damage, while 200 pounds to the acre nearly always caused great

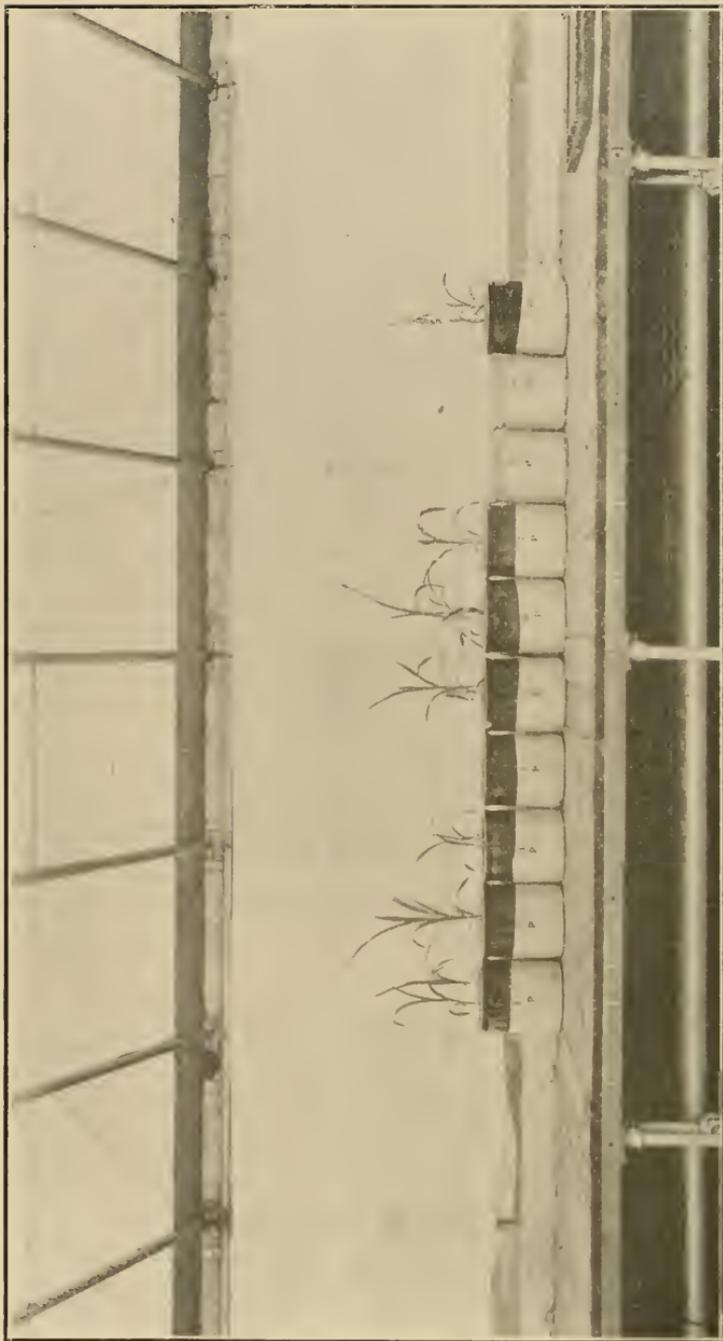


FIG. 1. Borax test with fertilizer on corn, Purdue soil.

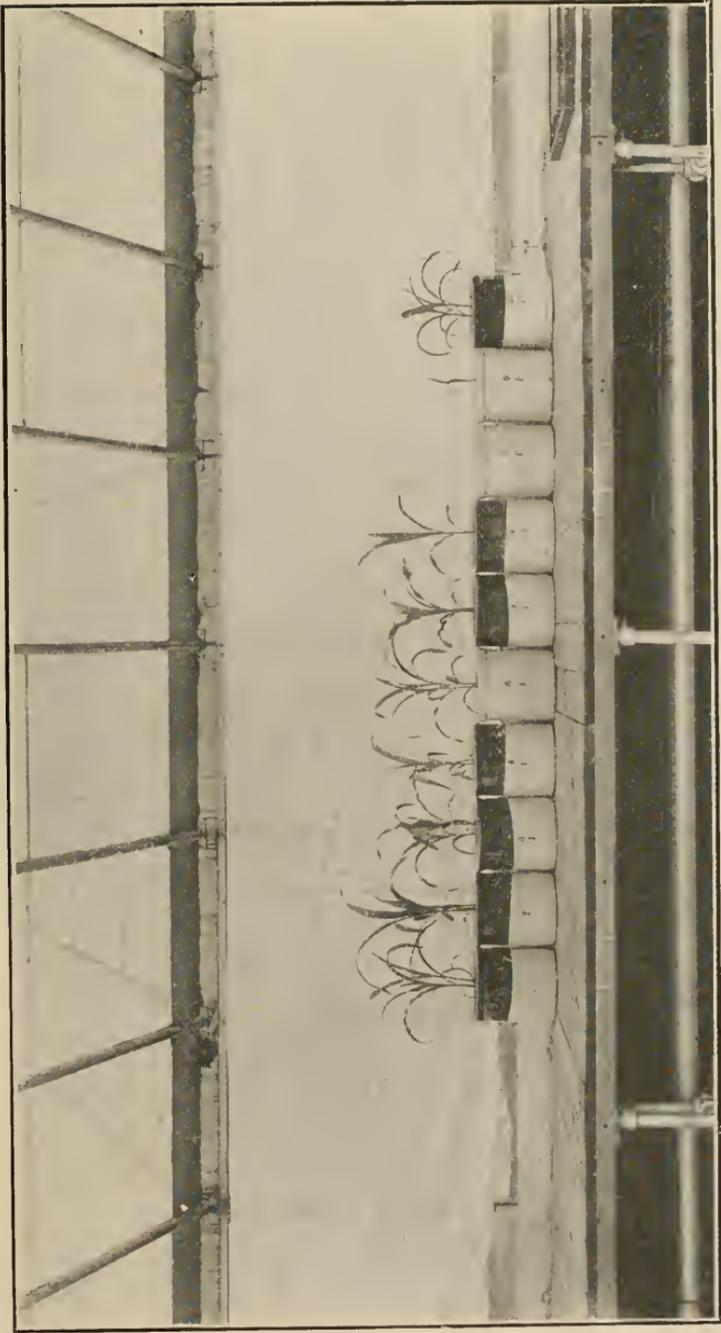


FIG. 2. Borax test with fertilizer on corn, Francesville soil.

damage. Some farmers seemed to think that a fertilizer attachment with a spreader was better than an attachment that placed the fertilizer directly on the seed. Differences in amount of injury were undoubtedly caused by the different weather conditions, such as rain either just before or after planting.

All farmers who had used fertilizer which caused damage to the corn and who made complaint have been compensated by the fertilizer company selling the goods. The amount of damage was mutually agreed upon by the farmer and a representative of the fertilizer company with O. S. Roberts, Chief Inspector of the State Chemist's Department of the Experiment Station, acting as a disinterested referee.

EXPERIMENTAL WORK.

To find the cause of the damage, the writer secured a sample of the 5-5 fertilizer which produced damage in one of the fields. Upon analysis this sample was found to contain 2.35 per cent boric acid (H_3BO_3) equivalent to 1.92 per cent borax ($Na_2B_4O_7$) soluble in water. Borax is an ingredient not usually found in fertilizer. It has been found by other investigators to be harmful when used in very large amounts.¹

With the assumption that borax might be the harmful ingredient, quantities of soil were obtained from the field near Francesville damaged by the particular sample of 5-5 fertilizer analyzed; also soil from the Experiment Station farm. The Francesville soil is a black sandy loam neutral in reaction. The Purdue soil is brown silt loam, acid in reaction. Ten earthenware pots were filled with each type of soil and fertilizer applied as follows:

Pot. No.

1. No treatment.
2. 50 lbs. per acre in row of 5-5 fertilizer sold.
3. 100 lbs. per acre in row of 5-5 fertilizer sold.
4. 200 lbs. per acre in row of 5-5 fertilizer sold.
5. 200 lbs per acre broadcast of 5-5 fertilizer sold.
6. 100 lbs. per acre in row 5-5 fertilizer made in laboratory. No borax.

¹ Cook, T. C. and Wilson, J. B. in Jour. Agr. Res., Vol. X, No. 12, 1917; also Nakamura in Bul. Col. Agr., Tokyo, 1903; also Voelcker in Jour. Roy. Agr. Soc., Vol. 76, 1915.

7. 200 lbs. Same as No. 6.
8. 100 lbs. per acre in row of 5-5 fert. made in laboratory with 2 per cent borax.
9. 200 lbs. Same as No. 8.
10. 200 lbs. per acre broadcast 5-5 fert. made in laboratory with 2 per cent borax.

Where the fertilizer was applied in the row, the soil was furrowed out and the fertilizer applied, then the corn dropped in the same furrow and covered. The broadcast application was worked in the entire surface of the pot two inches deep. Corn was planted October 8, 1917, and the pots were kept uniformly watered in a greenhouse.

The notes in Table I indicate the results on the test up to January 1, 1918. Figures 1 and 2 show the appearance of the corn November 26th.

The results obtained in this pot test show that without doubt the commercial 5-5 fertilizer containing 1.92 per cent borax will injure corn if applied in the row 100 lbs. or more to the acre. Fifty pounds to the acre caused no damage.

The damage is caused by preventing germination, by bleaching the leaves of the young corn and by stunting or killing the young plant. This injury is identical to that which was noted in the field.

A 5-5 fertilizer made from kainit and acid phosphate did not bleach leaves or kill the plants when used 100 or 200 pounds in the row. In the 200 lb. application, this fertilizer caused some temporary stunting which later disappeared.

An artificial 5-5 fertilizer with 2 per cent borax added caused bleaching and even worse damage than the commercial sample did.

When the fertilizer was applied 200 lbs. to the acre broadcast that containing borax caused a slight bleaching but no permanent injury.

There seems absolutely no question but that 2 per cent borax in a fertilizer when used 100 pounds to the acre in the row will bleach the leaves of the corn plant and cause more or less permanent injury.

