

OBSERVATIONS ON DAMAGE TO DRILLS BY COPPER CARBONATE TREATED WHEAT.

C. T. GREGORY and I. D. MAYER, Purdue University Agricultural Experiment Station.

Extensive experiments with copper carbonate treatment have never revealed any injury to wheat seed in impairing germination or otherwise reducing the yield. Our experience in Indiana further verifies this fact, but nevertheless a rather peculiar and dangerous difficulty has been experienced during the past two years, the breaking of drills while using copper carbonate treated wheat.

As has been previously reported¹ in 1924, seven farmers in Howard and Bartholomew counties reported the breaking of drills while sowing wheat treated with copper carbonate. In 1925 similar difficulties were reported from five counties and a close observation was made of two cases in Tippecanoe County.

During the early part of October, 1925, Paul Ford, a farmer in Tippecanoe County, broke the small bevel gear driving the force-feed shaft. According to his own statement he made two rounds on a 20-acre field on Saturday afternoon. He left the drill in the field but covered it with a tarpaulin till Monday morning before resuming the planting. He had not driven 30 feet when the gear broke and later he found that it was impossible to turn the gears without first working the drive wheel back and forth. By careful manipulation he finally loosened the feed discs so that they could be moved. The treated wheat was all removed, the broken gear replaced and the wheel turned till all the free copper carbonate was removed from the machine. After running the treated seed through a fanning mill to remove all the excess copper carbonate no further difficulty was experienced.

Ford found that the excess copper carbonate from the wheat had packed tightly around the force feed discs. But it is also noteworthy that during the time that the drill remained in the field there was considerable rain. This fact appears to be important since our experiments indicate that this trouble is associated with moisture. It is evident too that an excessive amount of copper carbonate is liable to be detrimental since the excess cannot be retained on the surface of the seed and will lodge in the seed cups of the drill. However, Ford only used about two and one-half ounces of copper carbonate per bushel.

D. A. Baker, another Tippecanoe County farmer, succeeded in planting 20 acres of treated wheat, but discovered when he put the drill away that the shaft driving the force feed wheels had been twisted. (Fig. 1). The machine used is an old-fashioned type in which the power is transmitted to the feed wheel shaft at one end rather than in the center. The torsion of the shaft began at the center of the drill and grew gradually greater till at the point where the power was applied it was twisted two and a half times.

¹Gregory, C. T. Loose and stinking smuts in Indiana. *Proc. Indiana Acad. Science* 34 :285-288. 1925.

"*Proc. Ind. Acad. Sci.*, vol. 34, 1925 (1926)."

This injury has always been associated with but one type of drill. The so-called "internal or double run grain feed" is the only type in which injury has been observed in Indiana. The comparatively broad surface of the feed wheel and its close adjustment to the feed cup is apparently the explanation of the excessive friction which develops from the copper carbonate. One of the indications that this injury is from friction is that the "fluted feed" drills are not, so far as is known, ever broken while drilling the treated seed. The surface exposed where friction may develop is much less in this type of feed mechanism.

Various experiments have been conducted to determine the nature of this injury. The first test made was one adapted from concrete experiments and is known as the "slump test". It would appear that if the coating of copper carbonate on the wheat seed created a friction that this fact would exhibit itself in a measurable way in the slump test. Accordingly a tin frustrum of a cone was made having these dimensions, 13 inches high, 4 inches across the top opening and 8 inches across the bottom. The wheat to be tested was poured slowly into the cone and tamped down with a quarter inch iron rod. The first evidence of a difference occurred during this tamping. In the untreated wheat the rod could rather easily be thrust to the bottom of the cone each time, even when it was completely filled with wheat. Under the same conditions with the copper carbonate treated seed it was difficult to force the rod more than a few inches into the wheat after the first few tappings. The cone was carefully filled to the top and leveled off with a straight-edge. After this the cone was lifted by hand but always by the same person and as nearly with the same speed as possible since it was found that when the cone is lifted quickly the results are somewhat different. In every case Michikoff wheat was used though it was found that a different variety of wheat makes little difference in the results.

To reduce the error as much as possible five different trials were made and the results are the average of these five trials.

TREATMENT	Height of Pile	Spread (Diameter of pile)	Increase in height over un- treated wheat (percentage)
Check untreated wheat	2.9375 inches	22.4 inches	
Commercial copper carbonate	4.05 inches	18.5 inches	37.8
M. Ewing Fox copper carbonate	3.9875 inches	19.9 inches	35.8
Corona copper carbonate	3.625 inches	20.25 inches	23.4
Copper stearate	3.425 inches	21.55 inches	16.6
Commercial copper carbonate and talc	3.6875 inches	21.3 inches	25.5

These data would indicate that under dry conditions the presence of copper carbonate on the surface of the wheat increases the friction from 23.4 to 37.8 per cent. Copper stearate on the other hand is apparently more oily and only increases the friction a little more than 16 per cent. The addition of talc to the commercial copper carbonate reduced the friction about 12 per cent.

Further laboratory tests were made to measure the power needed to sow treated and untreated wheat but with electrical apparatus no

constant differences could be measured. When the treated seed was left standing in the drill for 24 hours or longer we could prove no evident increase in the power needed. These experiments indicate that while the wheat is dry the application of copper carbonate does not increase the friction sufficiently to cause injury to the drill.

Further experiments conducted this fall by three Purdue University seniors, have shown quite conclusively that moisture is the essential factor in causing injury to drills. When wheat was treated with copper carbonate and sowed immediately there were no signs of a dangerous increase in power needed to turn the drill but when this same wheat was left standing in the drill over night, after having been run through the drill the previous day, it was very difficult to loosen the feed wheels.

All the experimental evidence and the observations of farmers who experienced this trouble, indicate that the breaking of drills is associated with moisture. It is probable that treated wheat will cause no injury if sown immediately after being put in the drill, even though the weather is wet.

If the treated wheat is left over night or longer in the drill during wet weather it will be necessary to tap the feed wheels to loosen any cementing action which may have occurred. Furthermore the drill should be worked back and forth till the feed gears work freely, else the sudden excessive power needed may break some part.

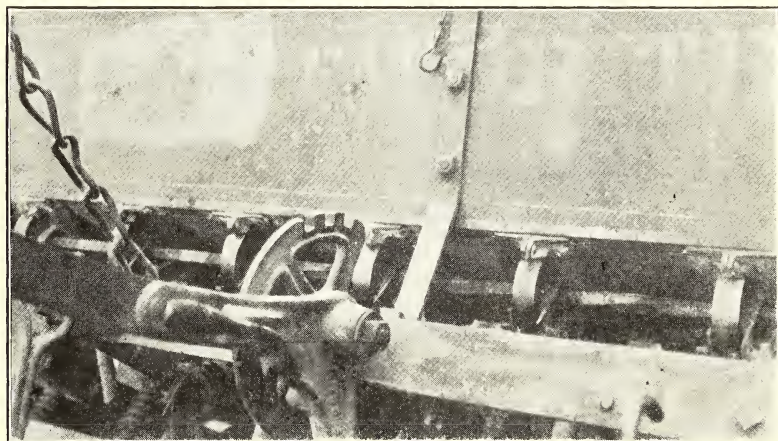


Fig. 1—A drill that almost broke while sowing copper carbonate treated wheat. The twisting of the feed wheel shaft is the result of the friction in the feed wheel.

