

COPPER DEFICIENCY DISCOVERED IN THE SUGAR BELT

By J. L. DU TOIT

With a few minor exceptions, trace element deficiency has not been of much importance in sugarcane production, but it is possible that the position may alter with continuous cropping. Sugarcane may not be quite so sensitive to trace element deficiencies as some other crops, but where severe deficiencies do exist the crop can be very greatly affected.

Thus in peat soils of the Florida Everglades sugarcane production was severely restricted before the discovery of copper deficiency and the fact that copper sulphate could correct this deficiency. Bourne¹ found that the application of 20 lbs. per acre of copper sulphate gave an enormous stimulation to the crop and this discovery led to the rapid expansion of the industry. Allison² described both copper and manganese deficiency in sugarcane in Florida. In Queensland³ restricted areas of copper deficiency are found and the cane responds very well to about 55 lbs. of copper sulphate per acre in these areas.⁴

During 1953, the writer visited Florida and found that manganese deficiency symptoms were now far more common than copper deficiency symptoms, but some of the latter were seen. It is, however, common practice to apply copper sulphate at the rate of 20 lbs. CuO per acre, manganese sulphate at the rate of 60 lbs. MnO per acre and zinc sulphate at the rate of 4½ lbs. ZnO per acre, at the time of planting on these deficient soils.

During March 1955, Mr. D. A. Routledge, Advisory Officer of the Experiment Station, brought in a cane stool showing decided green islands on the leaf laminae. The field in question on Glebe Section, Mission Reserve, between Sezela and Esperanza, on the South Coast was in a granitic area and the soil was probably derived from a para-gneiss. The field was considered good cane land and had grown normal, to better than normal, cane crops for the past thirty years. At the beginning of 1955, however, Mr. Brickhill, the section manager, noticed that there were patches of chlorotic and very stunted cane in the field and he drew Mr. Routledge's attention to them.

On visiting the area the following typical copper deficiency symptoms were found. The cane in affected areas was extremely stunted. The leaves drooped down and this was most abnormal for the variety Co.331. There were numerous green islands, or green blotches, on the somewhat chlorotic leaves. It was also noticed that there were several cases of cane stools in which the leaves failed to unroll as described by Allison. In this case, however, it was thought quite possible that the failing of the leaves

to unroll might have been the result of injury during cultivation and this symptom was not taken as necessarily indicating copper deficiency. The other abovementioned symptoms were, however, definite enough to suggest a copper treatment. In addition many leaves were characterised by yellow and green stripes and it was decided also to try out a manganese treatment.

It may be mentioned that this five-months-old affected plant Co.331 was in appearance quite different from what this variety normally looks like. Not only were the leaves drooping, but they were exceptionally broad. In the surrounding unaffected cane, which was normal in growth and appearance, there were definite signs of potash deficiency, but these were not apparent in the depressed copper deficient areas. Soil analyses showed a low potash content, a medium phosphate content with a pH of 5.6 and 3.2 per cent. organic matter content. Leaf analyses (third leaf mid-laminae samples) done on the affected and unaffected areas were as follows:

	Percentage Composition on Dry Basis		
	N	P ₂ O ₅	K ₂ O
Affected area... ..	2.17	0.71	1.53
Unaffected area ...	1.77	0.48	0.70

At the end of March the following treatments were applied:

- (1) a copper sulphate top dressing at the rate of 50 lbs. per acre;
- (2) a copper sulphate spray application at the rate of 30 galls. per acre of a 0.4 per cent. solution;
- (3) a manganese sulphate top dressing at the rate of 50 lbs. per acre;
- (4) a manganese sulphate spray application at the rate of 30 galls. per acre of a 0.4 per cent. solution.

A month after these applications were made the copper sulphate sprayed lines appeared much improved with no green islands, or yellow and green stripes visible, and much the same applied to the copper sulphate top-dressed lines. The manganese treated lines were, however, unchanged and the islands and stripes were as common here as in the control lines.

Towards the middle of May a similar copper spray application was applied in another patch of badly affected cane.

Towards the end of June the cane in the first copper treated lines, both spray and soil applications, had responded remarkably well and was a couple of feet taller than the untreated affected cane.

Deficiency symptoms had disappeared completely whereas they persisted in the untreated cane. In the treated area the cane once more looked typically like Co.331 with mainly upright and narrow leaves, while in the affected area the leaves were still broad and drooping. It was also interesting to note that the treated cane which had apparently thrown off all copper deficiency symptoms now started to show potash deficiency symptoms similar to those of the originally unaffected cane in this field.

By this time, too, the lines sprayed with copper sulphate during May had recovered completely as far as visible symptoms were concerned but they did not show any better growth than the surrounding cane. This was probably due to the severe drought experienced during that period, whereas the earlier treated cane could take advantage of the earlier rains and it was also situated in a more moist area.

It was at first thought that the discovery of this copper deficiency in our sugar belt may only be of academic interest and this may still be the case, but since then several leaf samples showing some resemblance to copper deficiency have been brought in and in one area on a recent sand at Flanders Estate of Natal Estates Ltd. the symptoms appears to be definite. Here the first leaf samples were brought in by Mr. V. Frances, Government cane inspector, and the worst affected area was found by Mr. K. E. F. Alexander of the Chemical Department. The area is at present under investigation, but indications are that it is a comparatively mild case of

copper deficiency and although a copper treatment appears to benefit the cane the untreated cane seems to recover too.

In this particular case the pH of the top soil is about 8 as a result of heavy applications of carbonation filter cake. The soil is high in phosphate but low in potash with an organic matter content of 1.5 per cent.

Summary

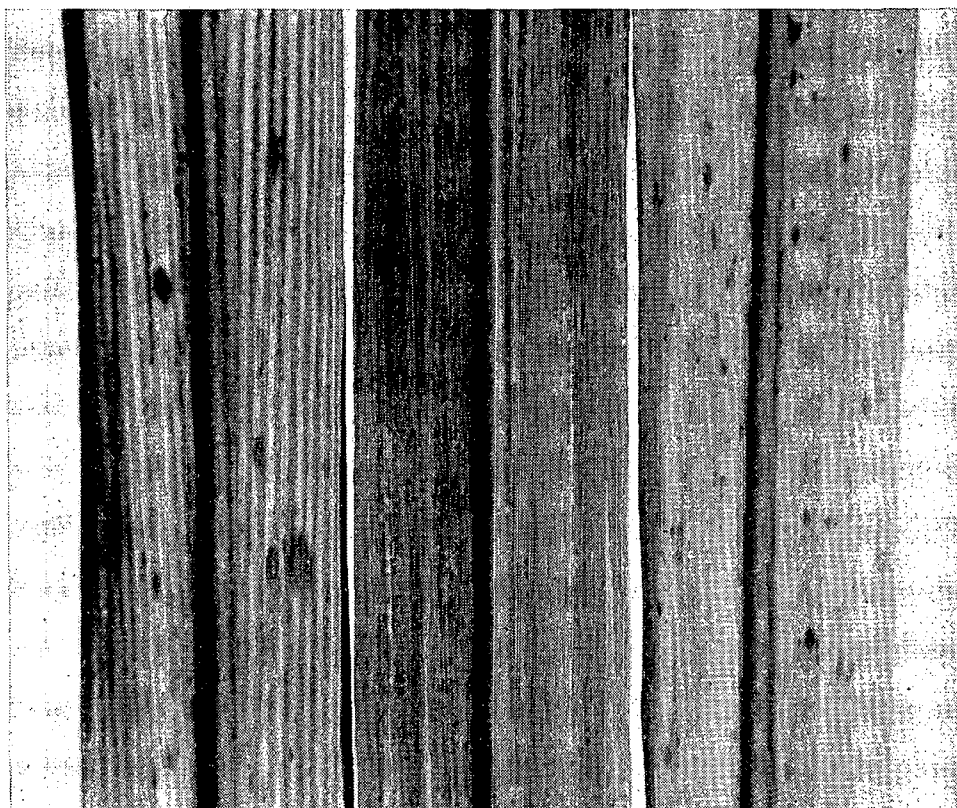
Copper deficiency has been discovered in a granitic area on the South Coast. Some leaf samples brought in from the North Coast show a resemblance to copper deficiency symptoms and one area of suspected mild copper deficiency is under investigation.

Acknowledgments

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REFERENCES

- ¹ Bourne, A. B. (1937): Special Chemicals and the Ripening of Sugar Cane on Raw Peat Soils. *Facts About Sugar*, **32**, 21.
- ² Allison, R. V. (1932): The Use of Less Common Elements as Soil Amendments for Sugarcane Production in South Florida. *Int. Soc. of Sugar Cane Tech. Bul.* 112.
- ³ King, N. J. *et al.* *Manual of Cane Growing*, 112.
- ⁴ — (1954): Copper Deficiency in the Central Area. *Cane Growers' Quart. Bul.*, 1st Oct. 1954, 61.



Copper deficiency symptoms on the left and right of a normal cane leaf.

Photograph : K. E. F. ALEXANDER.

Dr. J. Dick, in the Chair, said that his was a very interesting piece of investigation. Deficiency symptoms in sugar cane in South Africa had not been remarked upon much in the past and what had been found had been mainly due to the work of Mr. du Toit.

Dr. H. H. Dodds related that some years ago the chemist at Umfolosi, reported that he had found a cure for streak disease by applying manganese salts to the cane. This was tried out at the Experiment Station and it seemed that manganese treated cane did not show symptoms so early as untreated cane. However it did not cure the disease but merely delayed the appearance of the symptoms, and the treatment did not affect the yield in any way.

Mr. du Toit, replying to the Chairman, said that the reason for his being able to detect copper deficiency was the fact that he had seen copper deficiency overseas. This was a very good reason for sending men to overseas countries. He assured Dr. Dodds that by treating this cane with copper sulphate did not only make the symptoms disappear but the cane responded tremendously in yield and the pathologist found no evidence of a disease.

Mr. Twinch inquired of Mr. du Toit what would be the residual effects of copper treatment. Would it persist throughout the crop and would it be necessary to reapply it to the ratoons.

Mr. du Toit stated that in Florida it had been found that the application of about 50 lbs. of copper sulphate to plant cane was sufficient for all the ratoons. He did not think that the light spray application would persist in its beneficial effect to the ratoons. He said this matter would be followed up.

Mr. Barnes said it was a practice in Florida to apply copper, manganese and zinc at the time of planting and no further treatment was necessary until the field was replanted. He suggested that it be pointed out that this was not a very serious state of affairs as it was something that could easily and cheaply be corrected. He pointed out that up to now these copper deficiency symptoms had been found in the extreme ranges of pH variation, and it was possible that cane growing under these conditions might not be able to take up the required copper. He asked if Mr. du Toit had as yet tested for copper in the soil.

Mr. du Toit replied that the determination of copper both in the leaves and in the soil was under consideration and arrangements had been made to have a general survey of the sugar industry carried out with the aid of the Imperial College, Trinidad. If this could be done for other countries as well, we should be able to get an idea of our relative status as compared with such countries.

Mr. Coignet suggested that it would be a good idea to return ash from the factories into the fields.

Mr. du Toit replied that trace elements should be traced throughout the plant and in its final products.

Dr. Brett suggested that the low potash content of the cane in some parts of the field might have masked the copper deficiency.

Mr. du Toit replied that it might be possible for limiting elements to so affect the growth of the cane that it might mask deficiency symptoms of other elements; but he thought this would only happen in extreme cases of deficiency.

Mr. King suggested that the fact that Co.331 leaves in copper deficient areas appeared broad might merely be an optical illusion. He wondered if this was really the case or if measurements had been made.

Mr. du Toit stated that no measurements were made but the appearance of this cane was most striking as far as the broadness of the leaves was concerned.