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NUTRITIONAL DISORDERS OF POTASSIUM DEFICIENCY IN SORGHUM USING STILL CULTURE TECHNIQUE

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To produce, describe and record by colour photography the symptoms of nutritional disorders of potassium deficiency in sorghum, an experiment was designed and carried out in the glasshouse of the Department of Agriculture, University of Queensland using the still culture technique. Five nutrient levels of potassium were evaluated (1,10,90,850 and 8000 μM K). The first potassium deficiency symptom recorded was reduction in plant growth and dwarfing of plant size. The dark green colour of leaves changed to light green these symptoms were first recorded on old leaves. Marginal discoloration continued from the tips to the base of leaves. Eventually tissues of the leaf tips and edges died, leaving small areas at the bases and mid ribs green (popularly known as leaf scorch or tip burn). Except in 8000 μM K external solution, all other treatments showed K deficiency symptoms which suggests that 8000 μM K may be the external K requirement of the sorghum plant. However this needs further experimentation, Potassium efficiency was found to reduce the growth of plant tops more than the roots.

Key words: Potassium deficiency, root/shoot ratio, sorghum.

INTRODUCTION

After maize, sorghum is the second important crop of semi-arid and arid tropics. Relatively little information is available concerning the mineral nutrition of sorghum and there is lack of precise quantity data on external and internal nutrient requirements and also nutrient disorders. The present study was designed and carried out at Department of Agriculture, University of Queensland, with the main objectives to work out the best level of potassium concentration for optimum crop yield and also to produce, describe, and record by colour photography the symptoms of nutritional disorders of potassium deficiency in sorghum crop.

MATERIAL AND METHODS

To achieve the objectives following methodology was used:

Concentration of basal nutrients other than potassium were (μM) N 15000, Ca 5000, Mg 2000, Iron as Fe, EDTA 100 initially which was supplemented by 100 more, Cl 130, B 50, Mn 25, Zn 10, Cu 5, Mo 1.75, Si 500 respectively. Five nutrient concentrations of potassium were evaluated and they were:

Treatment	1	1 μM K
	2	10 "
	3	90 "
	4	850 "
	5	8000 "

Two replications of each treatment were made. A two litre solution containing all essential plant nutrients mentioned above were taken in plastic pots and potassium was added according to treatments. Seedlings of sorghum crop were transplanted in four small polyethylene plant support baskets of each pot on 4.3.82. After establishment of these seedling thinning was made in the following week and only one plant per pot was allowed to grow. Deionized water was supplied regularly depending upon water requirements of the plant. pH of the solution was adjusted to 5.2 ± 0.2 weekly. Nutrient solutions were aerated continuously for proper aeration of the roots of plants. Symptoms of nutritional disorders were recorded from time to time. The crop was harvested on 8.4.82 and yield data recorded.

RESULTS AND DISCUSSIONS

Reduction in the plant growth was the first peculiar symptom which was first recorded in 1 μM K concentration. Later the dark green colour of old leaves turned

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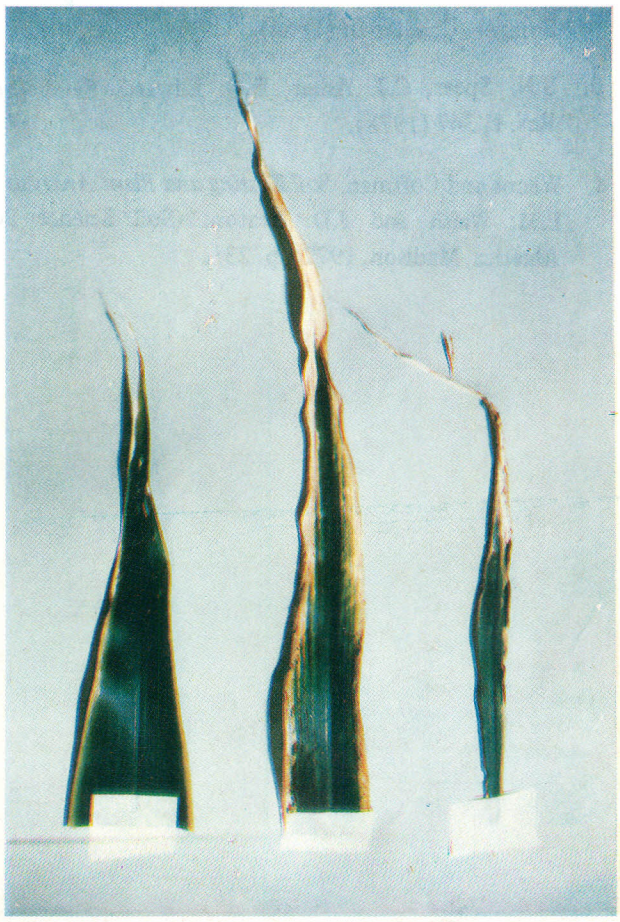

Fig. 1(b) Potassium deficiency symptoms in sorghum plants grown in a still culture experiment.

From right

i) Leaf of sorghum plant grown in 1 μM K. ii) Leaf of sorghum plant grown in 90 μM K. iii) Leaf of sorghum plant grown in 850 μM K.

Fig. 1(a) Potassium in deficiency symptoms sorghum plants (34 days old) grown in still culture experiment.

From left.

i) Plant grown in 1 μM K nutrient solution. ii) Plant grown in 90 μM K nutrient solution. iii) Plant grown in 8000 μM K nutrient solution.

to light green. Tips of old leaves were scorched and the burning of tips and margins were observed. With an increasing pace of time nutrient deficiency, symptoms of potassium became severe. Nature of the severety of these symptoms were in order of 1 μM > 10 μM > 90 μM K concentrations respectivley. (Fig. 1 (a) and Fig. 1 (b). The growth of plants grown in 850 μM K solutions was comparable with 8000 μM K plants upto 30 days of plant growth and symptoms of potassium deficiency then appeared on lower leaves of 850 μM K treatment. Here the tips of the older leaves were only scorched and other parts of the plant were normal as in 8000 μM K treatment. Though the appearance of the crop was good, yet signs of potassium deficiency showed that the external concentration of 850 μM K is not sufficient for maximum plant growth of the sorghum crop. In the case of 8000 μM K the growth of plants in both replicates was normal without showing any type of potassium deficiency symptoms. This also suggests that external solution required for proper plant growth is 8000 μM K. However this needs further experimentation. These nutrient deficiency symptoms observed here agree with the work done on other different crops [1,2,3,4].

The data further reveal that in the lower nutrient concentrations, i.e., upto 90 μM K, the root growth was greater than that of the tops. This shows that under deficiency conditions potassium has least effect on root development but rather shoots are affected more. Therefore, upto 90 μM K potassium concentrations, root weight ratio with shoots was great (0.64) which decreased to 0.31

when the plant was adequately supplied with K (1 μM 0.51, 10 μM 0.61, 90 μM 0.64. 850 μM 0.42 and 8000 μM 0.31).

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