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NITROGEN UPTAKE BY PINEAPPLES FROM UREA FOLIAGE SPRAYS

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SUMMARY

Fortnightly applications of a high rate of application caused burning and a negative growth response.

I. INTRODUCTION

A trial to test uptake of urea from a high-rate foliar application to pineapple plants was conducted in the glasshouse at the Pineapple Research Laboratory at Nambour, in south-eastern Queensland.

II. MATERIALS AND METHODS

The trial was set up as a 3 × 7 randomized block using the following treatments:

(1) No nitrogen solution + 10% urea foliage spray.

(2) No nitrogen solution.

(3) Full culture solution using ammonium sulphate.

Clonal pineapple tops were grown in 1-plant plots in 2 gal plastic buckets of sand. Culture solutions were applied at 500 ml per plant three times a week. Urea sprays were applied once a fortnight and the plants just wetted at hourly intervals throughout the day. Special precautions were taken to prevent urea spray falling on the potting medium and the accumulation of spray run-off in the heart of the plant. The application rate used was equivalent to 132 gal/ac, which is well in excess of the recommended commercial application rate of 30-50 gal/ac for a planting of 14,500 plants per acre.

III. RESULTS AND DISCUSSION

Plant damage.—Burn symptoms were noticeable within 4 days of spraying in late November and late December. The burning was of three types:—

(1) Tip-burn of leaves.

(2) Olive-green, water-soaked lesions which advanced from the leaf base with the leading edge convex towards the leaf tip. These later dried out to white areas with black margins.

(3) Black constricted areas near the leaf bases which became evident about 3 weeks after treatment. These areas did not dry out.

Harvest data.—The plants were harvested after 3 months and all surface residues removed by careful washing prior to preparation for drying. Fresh weight and oven-dry weight data are presented in Table 1.

TABLE 1

WEIGHTS OF PLANT MATERIAL HARVESTED

Treatment	Fresh Weight (g)		Oven-dry Weight (g)		
	Leaves	Stems	Leaves	Stems	Roots
1. Urea spray	155·8	30·1	37·9	4·2	4·4
2. No nitrogen	362·2	38·2	49·3	5·7	16·7
3. Full culture solution ..	436·3	45·1	59·6	6·5	14·2
Necessary differences for significance 5%	64·8	5·9	8·8	0·9	4·1
Necessary differences for significance 1%	90·8	8·3	12·4	1·3	5·7
Significant differences ..	2, 3 ⩾ 1 3 > 2	2 > 1 3 ⩾ 1 3 > 2	2 > 1 3 ⩾ 1 3 > 2	2, 3 ⩾ 1	2, 3 ⩾ 1

These figures show a positive growth response to root-applied nitrogen and a negative growth response to foliar-applied nitrogen. The low values for the foliar treatments are caused by the plant damage previously mentioned. Figure 1 illustrates the plants size differences. The chemical data are presented in Table 2. Nitrogen was estimated by a semi-micro Kjeldahl method.

TABLE 2

NITROGEN PERCENTAGE OF OVEN-DRY MATTER AND NITROGEN WEIGHT PER PLANT PART

Treatment	Leaves		Stems		Roots	
	N (%)	N (g)	N (%)	N (g)	N (%)	N (g)
1. Urea spray	5·33	2·26	3·63	0·15	0·43	0·02
2. No nitrogen	0·85	0·42	1·06	0·06	0·46	0·08
3. Full culture solution ..	1·40	0·84	1·34	0·09	0·62	0·09
Necessary differences for significance 5%	0·33		0·26		0·06	
Necessary differences for significance 1%	0·46		0·36		0·09	
Significant differences ..	1 ⩾ 2, 3 3 ⩾ 2		1 ⩾ 2, 3 3 > 2		3 ⩾ 1, 2	

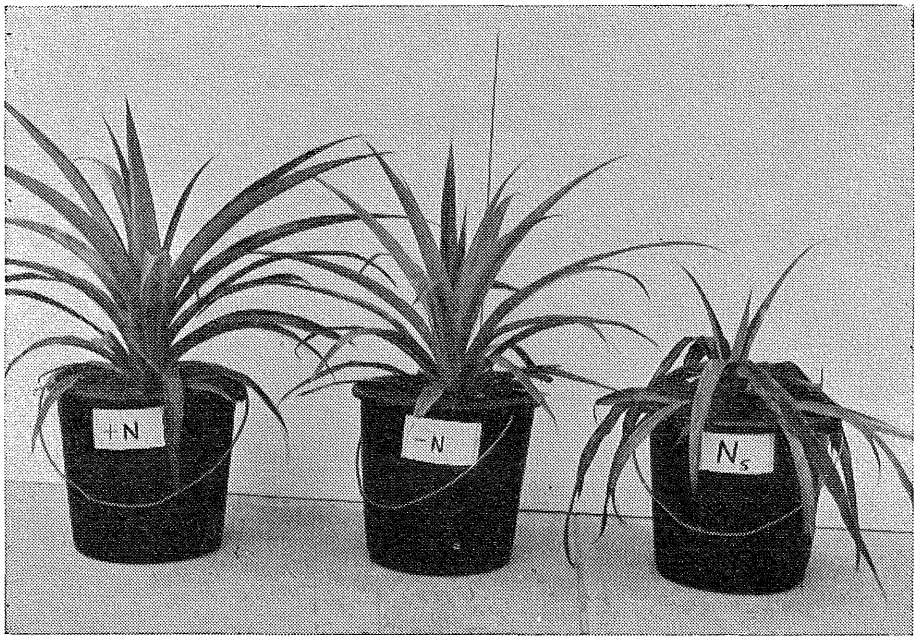

Fig. 1.—Plant reaction to treatments. Left, full culture solution. Centre, no nitrogen. Right, urea spray.

The data suggest that the intake of urea nitrogen through the leaf surface can be much higher than the uptake from a full culture solution, and that urea becomes phytotoxic at high rates of intake into leaves. The damage to leaf tissues appears to be caused by too slow an assimilation process for the rapid intake of the fat-soluble urea. Translocation of nitrogen into the stem, but not the roots, takes place in spite of leaf damage.

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