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FOLIAR UPTAKE OF POTASSIUM IN PINEAPPLES

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SUMMARY

Potassium sulphate was applied to the rooting medium or to the foliage only. Growth responses occurred only when it was applied to the medium.

A practical consequence of this is the use of high-volume, low-concentration sprays applied to the soil.

I. INTRODUCTION

The commercial use of foliar sprays of potassium sulphate in pineapples is increasing. This paper describes a trial set out to measure the response to foliar-applied and soil-applied potassium sulphate in the period of rapid growth prior to flower initiation for a plant crop.

II. MATERIALS AND METHODS

The trial was conducted in the Pineapple Research Laboratory glasshouse at Nambour, in south-eastern Queensland, from late November to mid April. Clonal pineapple tops (4-6 oz) were grown in 2 gal plastic buckets of leached sand with a layer of gravel in the bottom to facilitate drainage.

Treatments used were:

1. 5% potassium sulphate sprays
2. No potassium
3. Full culture solution

These three treatments were set out in a 7 × 3 randomized block arrangement of 1-plant plots. All pots were watered three times a week with a minus-potassium culture solution (Sideris and Young 1949). The full culture solution treatment had potassium sulphate added to the solution before watering.

The potassium spray treatment was applied once every 14 days to the foliage only. The pot and potting medium were covered with a plastic sheet to prevent spray falling on them. The heart of the plant was plugged with cotton wool to prevent any run-off, and to protect the tender newly formed leaves from direct spray contact. The foliage was just wetted at hourly intervals throughout the day.

When the trial was destructively sampled the plants were separated into leaves, stems, roots and longest-leaf samples. Each plant part was carefully washed to remove surface residues, weighed, cut up and dried in a forced-draught oven at 65°C. The oven-dried material was weighed and ground in an 8 in. C and N mill.

Potassium analysis was done by flame photometry on the water extract of the various plant parts. After the method of Mathis (1955) extraction from leaves and stems was performed by shaking and from roots by a boiling technique.

III. RESULTS AND DISCUSSION

The plant weight data means for the various treatments are presented in Table 1.

TABLE 1

FRESH WEIGHTS AND OVEN-DRY WEIGHTS

Treatment	Fresh Weight of Leaves (g)	Fresh Weight of Stems (g)	Oven-dry Weight of Leaves (g)	Oven-dry Weight of Stems (g)	Oven-dry Weight of Roots (g)
1. K_2SO_4 spray	687·3	58·67	92·94	9·06	36·79
2. No potassium	664·2	58·44	93·97	9·61	37·71
3. Full culture solution ..	855·9	71·09	118·96	11·16	37·51
Necessary differences for significance 5%	62·44	10·34	7·75	1·96	13·14
Necessary differences for significance 1%	87·54	14·50	10·87	2·74	18·42
Significant differences ..	3 ⩾ 1, 2	3 > 1, 2	3 ⩾ 1, 2	3 > 1	Nil

These data show no positive growth response to potassium sulphate sprays applied only to the foliage of the pineapple plant. Indeed, there was a very slight depression in oven-dry weight of leaves and stems of potassium-sprayed plants in comparison with the no-potassium control. The plants receiving the full culture solution had their potassium supplied to the rooting medium and showed a positive growth response in both fresh and oven-dry weight of leaves and stems. Root growth was similar, irrespective of the method of potassium application.

The longest-leaf length data taken during the period of the trial also showed a positive response to potassium applied to the rooting medium but no positive growth response to foliar-applied potassium. Figure 1 shows this graphically. Each point is the mean of the seven measurements taken on that particular day.

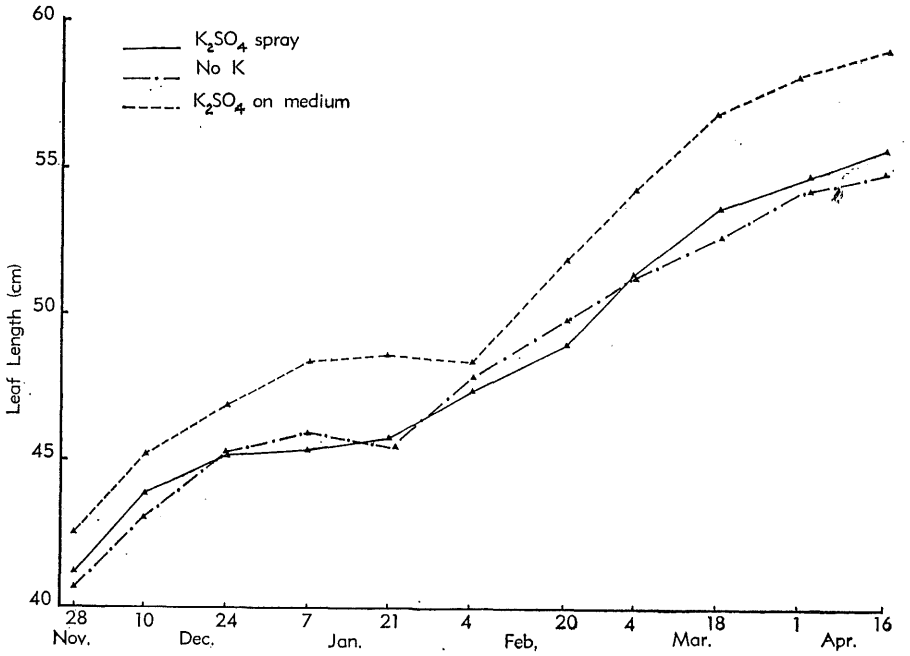

Fig. 1.—Longest-leaf length response.

The chemical analysis data for percentage potassium of various plant parts are presented in Table 2. These show that the potassium treatments both had a higher percentage of this element in leaves and stems than the no-potassium control.

TABLE 2

PERCENTAGE POTASSIUM OF OVEN-DRY WEIGHT

Treatment	Leaves	Stems	Roots
1. K_2SO_4 spray	4·56	1·72	0·30
2. No potassium	1·64	0·56	0·35
3. Full culture	2·99	1·48	0·20
Necessary differences for significance { 5%	0·36	0·20	0·04
{ 1%	0·51	0·28	0·06
Significant differences	1 ⩾ 2, 3 3 ⩾ 2	1, 3 ⩾ 2 1 > 3	1, 2 ⩾ 3 2 > 1

Despite the higher concentrations of potassium in both leaves and stems, there is no positive growth response to potassium sulphate foliar sprays. The absolute amounts of potassium in the various plant parts are expressed in Table 3.

TABLE 3

AMOUNT OF POTASSIUM IN PLANT PARTS

Treatment	Leaves (g)	Stems (g)	Roots (g)	Plant Total (g)
K_2SO_4 spray	4·23	0·15	0·11	4·49
No potassium	1·53	0·05	0·13	1·71
Full culture solution	3·54	0·16	0·07	3·77

These show that there was not a dilution effect because of the size difference. The relative order of magnitude for percentage potassium and total amount of potassium is similar. It is apparent that the sprayed plants contained sufficient potassium to give a growth response similar to that for the full culture solution treatment where the potassium is applied to the rooting medium.

It appears that the pineapple plant cannot use the potassium it takes up directly from foliage sprays. This suggests that any response to foliage sprays of potassium in the field is caused by the spray which falls on the ground, or leaf deposits washed down into the root zone by heavy dew or light rain. This could have a bearing on the best method of application of potassium sprays to pineapple plantations. It points towards the use of high-volume, low-concentration sprays which should put the potassium in the soil where the plant can use it more efficiently.

IV. ACKNOWLEDGEMENTS

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