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Agriculture Group Symposium Advances in Plant Nutrition

The following are summaries of papers presented at a meeting of the Agriculture Group of the Society of Chemical Industry held on 15 March 1988 at the Society of Chemical Industry, 14–15 Belgrave Square, London SW1X 8PS. The papers published here have not been refereed and do not necessarily reflect the views of the Editorial Board of the Journal of the Science of Food and Agriculture.

Potassium Nutrition of Tomato Plants: Effects of Restricting Potassium Supply to Day or Night

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Although it is well established that plants require large amounts of potassium to maintain normal growth, little is understood of the diurnal variation in uptake of potassium by intact plants. What differences are there in the rate of K^+ uptake between day and night, and are plants supplied with K^+ during the night only able to grow as well as those supplied with K^+ during the day? In order to investigate these questions, an experiment was designed to examine plant growth and composition under three different regimes of K^+ nutrition, namely K^+ supplied during the day (Kd), K^+ supplied during the night (Kn) and K^+ supplied day and night (Kdn).

Five-week-old tomato plants were grown hydroponically for 24 days in the following solution at pH 5.5: $Ca(NO_3)_2$ 2 mM, $MgSO_4$ 1 mM, $Ca(H_2PO_4)_2$ 0.5 mM. Potassium was supplied as K_2SO_4 0.5 mM and a full micronutrient solution was provided. The experiment was conducted in a growth room: theoretical light intensity $620 \mu\text{Einsteins m}^{-2} \text{s}^{-1}$, 12 h photoperiod and 23/19°C day/night temperature regime. The plants were moved to their day or night solution every 12 h, and solutions were replenished every 48 h. Four plants were harvested every 6 days and analysed for mineral composition. At the end of the experiment 12 plants were decapitated, in the middle of either the light or the dark period, and the bleeding sap was collected over a 3-h period and analysed for mineral composition.

Dry matter was not affected by the different regimes of potassium supply during the first three harvests. At the fourth, a significantly lower yield was recorded for Kn as compared with Kdn but not as compared with Kd. No significant differences were found between Kd and Kdn.

Significantly lower K^+ concentrations were found in the leaves and roots of the Kn treatment as compared with Kd and Kdn. However, the concentrations in the stem were similar, possibly indicating a greater pool of recirculating K^+ in the Kn treatment. The lower concentration of K^+ in the leaves of the Kn treatment was accompanied by an increase in Ca^{2+} concentration as compared with the two other treatments. The Mg^{2+} concentration of the leaves and roots followed a similar pattern.

Sap analyses performed at the end of the experiment were in accord with the above observations. When decapitation took place during the night, the sap of the Kn treatment was high in K^+ and low in Ca^{2+} , whereas, with decapitation during the day, the opposite was the case. For the Kd treatment the results were reversed and the Kdn showed an intermediate response.

In following the K^+ depletion from the nutrient solutions it was observed that the rate of depletion was greater in the Kd and Kn treatments than when K^+ was present during day and night (Kdn).

The following conclusions may be drawn from this experiment:

- (1) Satisfactory plant growth was obtained when plants were supplied with K^+ only during the night (Kn).
- (2) Potassium uptake adjusted to plant demand depending on the period of K supply. Thus during the night the rate of uptake of K^+ in the Kn treatment was greater than in the Kdn treatment, and similarly during the day K uptake was higher in Kd than Kdn.
- (3) When K^+ was not present in the nutrient medium, the plant compensated for the deficit of positive charge by greater accumulation of Ca^{2+} and Mg^{2+} .