SHORT COMMUNICATION

Varietal Differences in Potassium Uptake by Excised Roots of *Nicotiana tabacum*

It has been observed by Bortner et al. that the K-content of the leaf-web of ten varieties of field-grown burley tobacco (*Nicotiana tabacum*) ranged from 2.0 percent in low-K varieties to as much as 3.2 percent in high-K varieties. Because tobacco quality is closely related to K-content in the leaf, the mechanism accounting for these differences needs elucidating.

K-uptake by excised roots of different varieties of tobacco was studied to determine if the varietal differences were evident in very young plants and if the K taken up by the excised roots reflected field observations. Also investigated was the effect of substrate K-concentration on varietal differences in K-uptake.

Methods

Tobacco plants were germinated and grown for a period of approximately four weeks in vermiculite irrigated daily with nutrient solution No. 1 described by Hoagland and Arnon. The roots were then washed free of vermiculite, excised to 2 cm in length, and the plants were transferred to K-free nutrient solutions. One week after transplanting, the roots were again excised to 2 cm in length. This procedure was followed to obtain roots which contained low levels of K. The leaves of the plants usually began to show K-starvation symptoms after one week in the K-free solution. At the end of the second week the new roots (6 to 10 cm in length) were excised and washed thoroughly with distilled water. After washing, the fibrous root system of each plant was carefully separated and all roots were remixed to obtain homogeneous samples. The roots were blotted dry and 1 or 1.5 grams of roots were placed in Erlenmeyer flasks containing 1 liter of aerated treatment solutions. At the end of the sorption period of three hours the flasks contents were poured into a Buchner funnel and the solution was removed by suction. The roots were rinsed for at least 1 minute with a stream of distilled water and dried for 24 hours at 80°C.

The dry roots were weighed and digested with a mixture of 10:1 nitric-perchloric acid and potassium was determined by use of a flame photometer. Potassium uptake is expressed as me per 100 g dry weight.

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Effect of K-concentration on K-uptake by excised roots

Efforts to demonstrate varietal differences in absorption of K from solutions of $10^{-2} \, M$ KCl failed to show consistent differences. When $5 \times 10^{-3} \, M$ KCl was used, however, variety Bur 21 (Burley 21) absorbed approximately 20 per cent more K than did variety Ex 4 (Experimental 4). Prompted by these observations, the effect of substrate KCl concentration on K-uptake by these varieties was studied (Fig. 1). The values plotted are averages of three replications. With a substrate concentration of $2.5 \times 10^{-4} \, M$ KCl, K-uptake by Bur 21 was approximately two-fold greater than that of Ex 4. This difference appeared to progressively decrease with increasing KCl until at $1.6 \times 10^{-2} \, M$ KCl the K-uptake by the two varieties was essentially the same.

These observations become more significant when it is noted that the concentration of K in the soil solution is generally reported to be in the lower range of those concentrations used in this experiment. Burd and Martin reported that solution K of seven cropped soils ranged from $2.3 \times 10^{-4}$ to $1.25 \times 10^{-3} \, M$ and averaged $6.8 \times 10^{-4} \, M$. Fried and Shapiro reported that soil solution K is usually present in concentrations approximating $10^{-4}$ to $10^{-8} \, M$. A fertile, Maury silt loam soil from the University of Kentucky Agricultural Experiment Station Farm at Lexington contained $7.5 \times 10^{-4} \, M$ K in the soil solution at 25 per cent moisture.

Absorption of K from low-K solutions by excised roots of several burley tobacco varieties

Several varieties were compared for their ability to absorb K from solutions of $5 \times 10^{-4} \, M$ KCl. The results of two experiments are shown in Table 1. The values are averages of four replications.