

NOTIZEN

Differential Migration of Foliar Applied Zinc in Maize Plants

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Micronutrient, Zinc Ion Transport

The mobility of Zn^{2+} was assessed by supplying $^{65}\text{Zn}^{2+}$ to the different leaves of maize plants, and radioassaying the plant parts after 2 days. It was found that the 3rd leaf (from the base) absorbed more Zn^{2+} than other leaves. A larger percentage of Zn^{2+} transported, was identified in the stem in general. The study further revealed that there was a close link between the 1st and the 4th leaf for the transport of Zn^{2+} .

Mineral elements supplied to the root or the leaves have to be transported to different parts before their utilisation in their structure and function. The leaf is the seat of vital processes like photosynthesis, and also functions as a "sink" for mineral ions, too.

Micronutrients like Fe^{2+} , Mn^{2+} , and Zn^{2+} are considered to be poorly translocated from the site of absorption¹. However, our short-term studies have shown that the problem is more associated with the re-translocation from the older to younger leaves, rather than the transport from the root². The distribution of mineral elements into the leaves of a plant

is dependent on a number of factors, viz., the mobility of the element and the leaf age. The mobility is determined by measuring the rate of translocation of a radioactive element from leaf to leaf. The distribution of K^+ , Ca^{2+} , Mg^{2+} , and Mn^{2+} have been studied recently by Van Goor and Wiersma³. We have investigated the absorption and transport of Zn^{2+} by the different leaves of maize plants, and this information is basic to an understanding of the causative factors for poor mobility of Zn^{2+} .

Maize (*Zea mays*, cv. Hybridor) were grown in soil medium for 2 months, and plants having 5 leaves were selected for uniformity. The tip of a leaf of a plant was placed upto 2 cm deep into $^{65}\text{Zn}^{2+}$ labelled 0.1 mM ZnSO_4 solution (specific activity 10 $\mu\text{Ci}/\mu\text{mol}$, and pH 5.5) in a test tube, and after an absorption period of 2 days, was excised and desorbed⁴ for 1 hour. The transport of Zn^{2+} to the leaves and stem was measured from the radioactivity of the samples and expressed as nanomoles per plant part⁵. The position of the leaves is indicated by serial numbers beginning from the base to apex of the plant.

The results (Table) show that the amount of Zn^{2+} absorbed by the leaf part exposed to $^{65}\text{Zn}^{2+}$ is the highest for the 3rd leaf, followed by the 4th and 5th leaf. The amount transported to the rest of the treated leaf is more in the 1st leaf, and is the lowest in the 5th leaf. The greater transport within the 1st leaf is also observed when the values are expressed as a percent of the total transport.

Table. Absorption and transport of $^{65}\text{Zn}^{2+}$ to the leaves and stem, following the application to one of the leaves of maize plants. The values for the treated leaf is indicated by boldface types.

Content in Plant Parts	Leaf receiving the treatment, numbered from base to apex									
	1st leaf		2nd leaf		3rd leaf		4th leaf		5th leaf	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Treated leaf tip	6.59		15.77		42.79		29.35		18.14	
1st leaf	0.207	55.9	0.009	6.1	0.227	34.4	0.433	35.0	0.069	17.3
2nd leaf	0.025	6.8	0.114	64.4	0.024	3.5	0.049	3.9	0.076	19.1
3rd leaf	0.009	2.4	0.005	2.8	0.150	22.1	0.098	7.9	0.013	3.3
4th leaf	0.048	13.0	0.011	6.2	0.011	1.6	0.127	10.3	0.018	4.5
5th leaf	0.020	5.4	0.016	9.0	0.047	6.9	0.013	1.1	0.072	18.1
stem	0.061	16.5	0.022	11.5	0.221	31.5	0.516	41.8	0.150	37.7

(a), absolute amount, nmol per plant part; (b) percent of the total transported outside the treated part.

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The data on the transport to leaves and stem show that a larger percent is transported to the stem, in general. The transport to the stem is the highest when the 4th leaf is treated. The results indicate that Zn^{2+} is first accumulated in the stem before further transport to the different leaves. Furthermore, the pattern of retranslocation to other leaves from the treated leaf shows that there is a close connection between the 1st and 4th leaf. This is revealed by the largest amounts transported to the 1st and 4th leaf, when the 4th and 1st leaf respectively were supplied with Zn^{2+} . The relationship observed here is found to be consistent and the variability between the triplicate values is within a 10% range.

When the 1st and 2nd leaf were treated, larger amounts are found to be transported within the treated leaf, than to other leaves and stem. In contrast, larger amounts of Zn^{2+} absorbed by the 3rd, 4th and 5th leaf are transported to the stem, 1st and 2nd leaf, showing that there is a rapid downward transport from the 3rd leaf and above, while the upward transport from the 1st and 2nd leaf is rather limited.

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¹ M. J. Bukovac and S. H. Wittwer, *Plant Physiol.* **33**, 428 [1957].

² S. Ramani and S. Kannan, *Physiol. Plant.* **33**, 133 [1975].

³ B. J. Van Goor and D. Wiersma, *Physiol. Plant.* **31**, 163 [1974].

⁴ S. Kannan, *Planta* **96**, 262 [1971].

⁵ S. Kannan and T. Mathew, *Plant Physiol.* **45**, 206 [1970].