

# Zinc in Bean Plant Organs Derived from the Seed

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## INTRODUCTION

How much is the contribution of a seed-derived nutrient to the total plant content? This information becomes important when young plants are analyzed for nutrient content and the proportion of seed-derived nutrients is considerable (e.g., for the isotopic L value determination). Muraoka et al. (1987) observed that 31 to 52% of the total N in plant organs was seed-derived N. There is no similar study for Zn in bean plants. The objective of this study was to determine the contributions of seed-derived Zn to the total Zn content of different organs of bean plants at 15 and 30 days of growth.

## METHODS

Bean (*Phaseolus vulgaris* L, cv. “carioca”) seeds labeled with  $^{65}\text{Zn}$  were obtained from plants grown in  $^{65}\text{Zn}$  labeled soil (175 KBq  $^{65}\text{Zn}$  kg $^{-1}$ ). Two pods containing 6 seeds each were chosen, 2 for radioactivity and total Zn-content measurement and 4 for the experiment. These seeds were weighed and the  $^{65}\text{Zn}$  radioactivity was measured. The seeds were sown separately in pots filled with 2 kg soil, fertilized with N, P and K. The plants were grown and harvested 15 (1<sup>st</sup> stage) or 30 days (2<sup>nd</sup> stage) after emergence (DAE), divided into root, primary leaves, stem and trifoliolate leaves (1<sup>st</sup> stage) or roots, primary leaves and remaining above ground parts (2<sup>nd</sup> stage) and analyzed for total Zn content ( $\text{Zn}_t$ ) and  $^{65}\text{Zn}$  radioactivity. The seed-derived Zn in plant organs was calculated using the following equation:

$$\% \text{Zn}_{\text{pds}} = (\text{SA}_p / \text{SA}_s) 100, \text{ where}$$

$\text{SA}_p$  = Specific activity ( $^{65}\text{Zn}:\text{Zn}_t$ ) of plant organ,  $\text{SA}_s$  = Specific activity ( $^{65}\text{Zn}:\text{Zn}_t$ ) of seed. The percentage distributions of seed-Zn to plant organs ( $\text{Zn}_{\text{sp}}$ ) were also determined.

## RESULTS AND DISCUSSION

At 15 DAE (Table 1a), 27.5% of seed-Zn had migrated to primary leaves, while 5, 4.5, 14, 8.5 and 5% migrated to roots, stem, and to first, second and third trifoliolate leaves (TL), respectively, totalizing 64.5%, from which 59.5% were transported into above ground parts. The remaining 35.5% were presumably the amount contained in seed integument and cotyledons. These values represents, in relation to the total amount of Zn in the organs, 1% in the roots, 3.9% in stem, 22.9% in the primary leaves, 7.2% in the 2<sup>nd</sup> TL and 5.8% in the 3<sup>rd</sup> TL. The seed-derived Zn corresponds to 5.5 and 8.9% of whole plant and above ground part, respectively.

At 30 DAE (Table 1b), the total migrated seed-Zn is similar to the value at the previous stage (64.0%). The values in the primary leaves, however, decreased, indicating that there was redistribution to younger plant organs. Due to plant growth, the absorption of soil-Zn and redistribution of Zn migrated from the seed within the plants and the contribution of seed-Zn decreased considerably: 0.35% in roots, 16.8% in the primary leaves and only 2.7% in the whole plant and 3.91% in the above ground part.

**Table 1. Seed derived zinc in the bean plant organs at 15 and 30 days after germination (mean values of 3 plants).**

<b>a) 15 DAE</b>									
	Roots	Stem	Primary leaves	1 <sup>st</sup> trifoliolate	2 <sup>nd</sup> trifoliolate	3 <sup>rd</sup> trifoliolate	Above ground	Whole plant	Rest
Dry matter weight (g)	1.172	0.415	0.528	0.760	0.470	0.228	2.401	3.573	
Zn content (µg/g)	85	55	46	52	65	76			
Zn content (µg)	100	23	24	39	31	17	134	234	
Zn <sub>sp</sub> * (%)	5.0	4.5	27.5	14.0	8.5	5.0	59.5	64.5	35.5
Zn <sub>sp</sub> (µg)	1.0	0.9	15.5	2.8	1.5	1.0	11.9	12.9	7.1
Zn <sub>pds</sub> ** (%)	1.0	3.9	22.9	7.2	5.4	5.8	8.9	5.5	
<b>b) 30 DAE</b>									
	Roots	Primary leaves (PL)	Above ground	Above ground - PL	Whole plant	Rest			
Dry matter weight (g)	5.103	0.443	6.613	6.180	11.716				
Zn content (µg/g)	80	57		43					
Zn content (µg)	408	25	290	265	698				
Zn <sub>sp</sub> (%)	7.0	21.0	57.0	36.0	64.0	36.0			
Zn <sub>sp</sub> (µg)	1.4	4.2	11.4	7.2	12.7	7.2			
Zn <sub>pds</sub> (%)	0.35	16.8	3.91	2.7	1.83				

\* Zn<sub>sp</sub> = Seed Zn migrated to plant organ  
\*\* Zn<sub>pds</sub> = Zn in the plant organ derived from the seed

## CONCLUSIONS

The contribution of seed-derived Zn to the plant-Zn content is substantial depending on the plant organ, being the highest in primary leaves (23% at 15 DAE and 17% at 30 DAE). Considering the total above ground part, however, it represents less than 4.0 % at 30 DAE.

## ACKNOWLEDGEMENTS

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## REFERENCES

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