

## REASSESSMENT OF THE RELATIONSHIP BETWEEN SEED WEIGHT AND SEED CALCIUM

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### Introduction

Seed calcium concentration [Ca] was negatively related to seed weight (mg seed<sup>-1</sup>) ( $r=-0.78$ ,  $P<0.001$ ) in field studies involving eight bean cultivars (2 Navy, 1 Great Northern, 1 Pinto, 1 Cranberry and 2 Red Kidney) grown at five locations in North Dakota and Minnesota (Moraghan and Grafton, 2001).

**Mexican Study:** As part of a study involving genetic diversity in regards to zinc concentration [Zn] in bean seed, 29 bean genotypes from the Middle American gene pool were grown to maturity in a greenhouse study at Montecillo, Mexico. Four of the genotypes in the Mexican Experiment, the relatively photoperiod insensitive 'Voyager' (Navy), 'Norstar' (Navy), 'Othello' (Pinto) and 'T39' (Black), were also included in the earlier study (Moraghan and Grafton (2001). The remaining 25 genotypes were from Mexico (23) and Brazil (2). There was no tendency for an inverse relationship between seed weight and seed [Ca] in this genetic population (Table 1). The relatively large-seeded 'Pasella Teocaltiche' (577 mg seed<sup>-1</sup>) had the highest seed [Ca] (2.2 g kg<sup>-1</sup>).

**Table 1.** Relationship between seed dry weight and seed Ca concentration in a Mexican greenhouse study.

Parameter	Seed weight (x) <sup>1</sup> mg seed <sup>-1</sup>	Seed Ca (y) <sup>1</sup> g kg <sup>-1</sup>
$\bar{x}$	351	1.59
SD	113	0.33
Range	180-650	1.0 to 2.2

<sup>1</sup>Relationship between seed [Ca] and seed weight:  $y=0.00104x + 1.23$  ( $r = 0.35$ ).

**Additional Seed-Class Studies:** Because of the discrepancy between results of the earlier studies, seed from several North Dakota and Minnesota seed-class variety experiments conducted in 2000 were analyzed for Ca. Pertinent particulars about the experiments are given in Table 2. The linear correlation coefficient (r) between seed dry weight and seed [Ca] was -0.879 ( $P<0.001$ ), in agreement with the earlier American field study.

**Table 2.** Seed weight and seed-Ca concentration in several seed class common bean experiments in 2000.

Parameter	Trial							
	Navy		Pinto		Kidney and Cranberry (Perham, n=15) <sup>1</sup>		Kidney and Cranberry (Park Rapids, n=11) <sup>1</sup>	
	Seed weight mg seed <sup>-1</sup>	Ca g kg <sup>-1</sup>	Seed weight mg seed <sup>-1</sup>	Ca g kg <sup>-1</sup>	Seed weight mg seed <sup>-1</sup>	Ca g kg <sup>-1</sup>	Seed weight mg seed <sup>-1</sup>	Ca g kg <sup>-1</sup>
$\bar{x}$	181	2.28	368	1.40	515	1.08	555	0.96
SD	18	0.32	20	0.1	38	0.25	6.5	0.18
CV	10	14	5	13	7	24	12	18
Range	150-233	1.6-2.9	342-406	1.0-1.6	443-579	0.7-1.7	473-653	0.58-1.22

<sup>1</sup>n indicates the number of entries in the particular trial.

The large-seeded Kidney and Cranberry lines at the Park River and Perham sites had very low seed [Ca]. Were environmental rather than genetic factors responsible for this result? We do not believe that this was the case. The Kidney bean 'Montcalm' and the Navy bean 'Norstar' were both included in the earlier published study and had seed [Ca] values of 1.1 and 2.0 g kg<sup>-1</sup>, respectively (Moraghan and Grafton, 2001). 'Norstar' seed from the 2000 Erie Experiment contained 2.1 g Ca kg<sup>-1</sup>. In contrast, 'Montcalm' seed from the 2000 Perham and Park Rapids Experiments contained 1.0 and 0.9 g Ca kg<sup>-1</sup>.

### Conclusions

There is no general relationship between seed [Ca] and seed weight in *Phaseolus vulgaris* (L). However within American Navy, Pinto and Red Kidney seed classes, seed [Ca] is inversely related to seed weight. Data for 'market basket' samples of Navy (n=45), Pinto (n=57) and Red Kidney (n=50) seed classes in the United States also give credence to this relationship between seed [Ca] and seed weight. 'Market basket' samples of Navy, Pinto and Red Kidney seed classes had [Ca] values of 1.77, 1.36 and 0.94 mg kg<sup>-1</sup>, respectively (U.S. Department of Agriculture, 2001).

### References

- Moraghan, J.T. and K. Grafton. 2001. Genetic diversity and mineral composition of common bean seed. *J. Sci. Food Agric.* 81:404-408.
- U.S. Department of Agriculture. 2001. USDA nutrient database for standard reference. [Online]. Release 14. Nutrient data laboratory home page. Available at <http://www.ndal.usda.gov/fnic/food-comp> (verified 26 July 2001; this web site has replaced USDA-SCS Agric. Hand. 8).