Impact Analyses   (SBDPPS data)

These impact analyses were based on the subset SBDPPS data set (n=491).   The analyses controlled for unobserved book effects.

A linear mixed effects model with a book-specific random intercept was used.
In R notation... y ~ Gel + logCa + logK + logS + logFe + logAl + (1|book)
              where y is the response variable, which is one of   Delta L* or Delta A*.

Results...

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Effect on Delta L*...

Covariate	Increment in Covariate	Change in Delta L*	Margin of Error	P-Value	
Gel	3.06	1.723202	0.5785996	1.288812e-09	
Ca	166.18%	2.15856	0.6019778	3.707385e-13	
K	113.62%	-1.754344	0.687418	1.661388e-07	
S	169.22%	-0.1153216	1.131557	0.4192439	ns
Fe	45.61%	-1.879017	0.4546646	6.955054e-17	

sd(DeltaL*) = 6.12

To make the comparisons fair, all Increments in Covariates correspond to the respective covariate's standard deviation.   Because Ca-Fe were entered into the model on the log scale, the increments are multiplicative.

As examples,
  Controlling for the effects of all the other covariates and unobserved book effects, a 3.06 unit increase in Gelatin is associated with an estimated 1.72 unit increase in Delta L*. The margin of error is 0.579 and the p-value is < .0001.   (Note that the estimate +- margin of error gives a 95% confidence interval.)

  Controlling for the effects of all the other covariates and unobserved book effects,   a 166% increase in Calcium is associated with an estimated 2.16 unit increase in Delta L*. The margin of error is 0.602 and the p-value is < .0001.

Note: S and Al are NOT statistically associated with Delta L*, once the other covariates are included in the model--the p-values are 0.419 and 0.071, respectively.

Note: To get an idea of how big the change in Delta L* is, compare it to the standard deviation sd(Delta L*) = 6.12.

A rank ordering of the "impact of covariates" can be based on the absolute magnitudes of the values in the column labeled "Change in Delta L*" and the margin of errors in the column labeled "Margin of Error."

Define the *conservative estimate of impact* as CEI = minimum{|u|: d − me ≤ u ≤ d + me}, where d is the estimate of the Change in Delta L* (corresponding to a 1 standard deviation in the covariate) and me is the margin of error associated with this estimate.

As an example, suppose that the estimated change in Delta L* is d = 1.723, with me = 0.579. Then plausible estimates of the actual change in Delta L* include values between 1.144 and 2.302. Thus, a plausible estimate of the change in Delta L* is as close to 0 as 1.144. By the definition of CEI, we have EEI = 1.144. (See the 3 number-line graphics below for other examples.)

----------------0---------[1.144-----1.723----2.302]---   Then CEI= 1.144 (plausible estimates as close to 0 as 1.144)

------------[-0.2---0--------1.2------------2.6]-------------   Then CEI = 0   (0 is a plausible estimate)

------[-1.2---- -1.0 ---- -0.8]-----0-----------------------   Then CEI = 0.8   (plausible estimates as close to 0 as -0.8)

Based on CEI, we have the following:
Impact Ranking (Response = Delta L*) ... **Ca >** Fe **> Gel >** K > S.   [Emboldened factors have a positive effect]

Disclaimer: The impacts of the first four of these covariates look very similar. The S effect is not statistically significant.

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Effect on Delta A*...

Covariate	Increment in Covariate	Change in Delta A*	Margin of Error	P-Value	
Gel	3.06	-0.5965042	0.2003890	1.312632e-09	
Ca	166.18%	-0.8281332	0.2082527	9.090742e-16	
K	113.62%	0.580289	0.2379181	5.356817e-07	
S	169.22%	0.1315281	0.3912467	0.2506792	ns
Fe	45.61%	0.639915	0.1572182	1.968772e-16	

sd(Delta A*) = 2.152064

For example,
  Controlling for the effects of all the other covariates and unobserved book effects, a 45.61% increase in Fe is associated with an estimated 0.64 unit increase in Delta A*.

Based on CEI, Impact Ranking (Response= Delta A*) ... Ca **> Fe >** Gel **> K >** S
The S effect is not statistically significant.