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Seed inorganic phosphorus stability and agronomic performance of two low phytate soybean lines evaluated across six southeastern U.S. environments

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Non-digestible phytate salts chelate nutritional minerals in the digestive tract of mono-gastric animals. They are an unwanted component of soymeal and a documented source of non-point phosphorus (P) pollution to the environment. Lowering soybean phytate levels would ease environmental concerns and improve soymeal mineral bioavailability. In 2013, a field trial consisting of two University of Tennessee low phytate (LP) lines (56CX-1273 and 56CX-1283) and two high yielding check cultivars ('5002T' and 'Osage') were planted in four row plots in two replications at six Southeastern locations in a randomized complete block design to evaluate the LP lines for agronomic performance, seed quality traits and inorganic phosphorus (Pi) stability. Results revealed that there were no significant differences ($P > 0.05$) for mean seed yield or field emergence (germination) between the two LP lines and the two cultivars. Although the genotype by environmental ($G \times E$) index linear regression of seed Pi for the two LP lines revealed a slope that was significantly different ($P < 0.001$) from zero, and therefore not stable across the six environments, the mean Pi concentrations for LP lines 56CX-1273 ($2084.7 \mu\text{g g}^{-1}$) and 56CX-1283 ($1744.4 \mu\text{g g}^{-1}$) were still about an order of magnitude greater than the means of Osage ($185.7 \mu\text{g g}^{-1}$) and 5002T ($228.0 \mu\text{g g}^{-1}$). This study documents that a LP line can produce seed yields statistically equivalent to high yielding check cultivars with no germination issues.