

To: The Editors of Field Crops Research

Re: Submission of the manuscript, “Local to continental-scale variation in fitness and heritability in common bean (*Phaseolus vulgaris*)”.

Dear Editors,

We are pleased to submit this manuscript for consideration to *Field Crops Research*. We believe it will support the journal’s tradition of publishing papers of relevance to scientists interested in understanding the roles of selection and genetic variation in shaping the performance of agronomic crops across changing conditions. We quantified the impact of domestication and recent selection histories on the local adaptation and yield heritability of *Phaseolus vulgaris* L. (common bean). *P. vulgaris* is a unique model system for studying these processes: It was independently domesticated multiple times from different genepools; one of the domestication events resulted in an unusual increase in genetic diversity; and modern selection has occurred at both continental and regional scales simultaneously. We used data from the Cooperative Dry Bean Nursery (CDBN), a continental-scale multiple environment trial with 35 years of phenotypic data for over 300 genotyped entries.

We specifically addressed the Questions:

- 1) How has recent selection history impacted yield heritability in two genepools of *P. vulgaris*?
- 2) How has selection for both broad and regional adaptation affected environmental specialization?

To answer these, we characterize adaptability using complimentary metrics: the recently-derived “home field advantage”, which quantifies site specialization of individual entries through site-specific yield gains, and population-level yield heritability. These metrics were dynamic across locations and time, sensitive to major gene introgressions, and spatially independent. They revealed nuanced, actionable insights into the potential of crop populations to maintain performance in changing conditions. The interplay between specialization and genetic variation provides insight into urgently important evolutionary processes. Given the unprecedented pressures of food demand, environmental degradation, and climate instability, the ability to select varieties that are adapted to new conditions will be critical to maintaining oft-precarious local food security.

We anticipate that this paper will further support *Field Crops Research*’s mission by highlighting how local adaptation and spatial differences in heritability may be leveraged to improve the performance of agronomic crops. On behalf of my co-authors, thank you for your consideration. We look forward to working with you.

With kind regards,

Dr. Patrick Ewing
USDA-ARS North Central Agricultural Research Laboratory
Integrated Cropping Systems Research Unit
2923 Medary Avenue
Brookings, SD, USA