

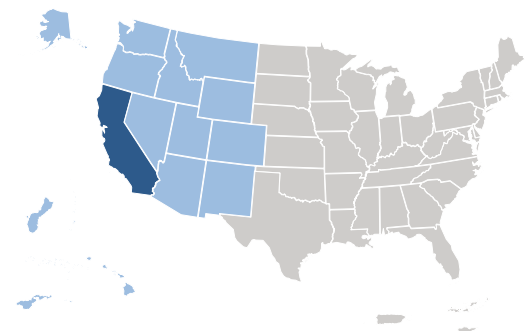


Development of New Selection Tools and Crop Varieties for Sustainable Agriculture



Dry bean seed varieties. Credit: Tayah Bolt

Genetically crossing heirloom dry beans with major commercial types achieved six new, high-yield, high-market value varieties distributed nationally and internationally through grassroots methods.



Region: Western
State: California
Grant Type: Graduate Student
Grant: [GW18-062](#)

VIABLE HEIRLOOM VARIETALS

“ The varieties released from this project combine the high-market value of heirlooms with the high productivity of commercial types and several are highly productive across environments.”

—Travis Parker, Graduate Student Grantee

SARE POST-PROJECT EVALUATION IMPACT MODEL

HIGHLIGHTS

Grantee (Graduate Student)	Other Stakeholders (Producers, Students)
<ul style="list-style-type: none"> ✓ Increased knowledge/skills ✓ Increased capacity/motivation ✓ Increased engagement ✓ Practice change ✓ Career growth 	<ul style="list-style-type: none"> ✓ Increased knowledge/skills ○ Increased capacity/motivation ○ Increased engagement ✓ Practice change ○ Career growth

SUSTAINABILITY IMPACTS

- ✓ Environmental Sustainability Impacts
 - ✓ Economic Sustainability Impacts
 - ✓ Production Efficiency Impacts
 - Social Sustainability Impacts
- ✓ = Project-Specific Areas of Success

GRASSROOTS DISSEMINATION OF NEW VARIETALS

“The vision I have for these is for them to filter through the sustainable agriculture community in a grassroots way, having them reach as many growers as possible and allowing them to make as big of an impact as they can. We want people to try them out freely and see what they think is best for their environment and market... We can distribute small amounts of seed and growers have been able to increase it thirtyfold from year to year to scale it up.”

—Travis Parker, Graduate Student Grantee

THE SUCCESS STORY

Organic and sustainable farmers who use limited herbicides face significant challenges with weed control when growing legumes. Rapid canopy growth allows for mechanical weed control and reduces hand-weeding costs, in addition to making plants more resistant to abiotic pressures such as heat stress. Travis Parker developed inexpensive, cutting-edge imagery acquisition and processing methods (i.e., a processing pipeline for Unmanned Aerial Vehicle imagery) to identify genetic patterns unique to dry bean varieties with an optimal canopy structure and vigorous growth rate. He also bred varieties that combined the virus resistance and high yield of commercial varieties with the high-value seed type and culinary flavor of heirloom varieties. These releases performed well in taste tests and have been registered and released to hundreds of growers, and are now sold commercially.



Travis Parker, graduate student grantee, tending beans in the UC Davis greenhouse. Credit: Anham Raffique

GRANTEE (GRADUATE STUDENT) HIGHLIGHTS

At the time of this grant, Parker was a doctoral student researcher at UC Davis. He has continued using these breeding techniques to understand the genetics of seed color patterns that give smaller-scale (and often organic) producers a unique market niche with higher-market value. He also applied the UAV techniques to study other crops including alfalfa and spinach. Building from his graduate research, Parker obtained numerous additional grants, publishing extensively about these projects in peer-reviewed journals and industry publications. Additionally, Parker created a YouTube channel with thousands of subscribers and views, which features 21 videos showcasing his work in English, Spanish, French, and Portuguese. Most recently, he has consulted with Kirkhouse Trust-funded programs across East Africa.



UC Davis picnic day. Credit: Travis Parker



OTHER STAKEHOLDER (PRODUCERS, STUDENTS) HIGHLIGHTS

During the grant period, Parker disseminated his learning through meetings and symposia. He created an undergraduate course curriculum to deliver his newly-developed phenotyping methods to undergraduate and graduate students at UC Davis. The course covered both theoretical and practical aspects of the use of drones in agriculture, culminating with a final project in which students posed a research question and answered it using the skills they developed in the class. Parker also delivered an abbreviated version of this content to producers to help inform their management decisions, which was highlighted in an article in Organic Farmer magazine. Other researchers have conducted trials with the new varieties in Wyoming, New York and elsewhere, and Parker's varieties have shown strong heat- and drought-tolerance in locations impacted by climate change.

DISSEMINATING UAV TECHNOLOGY

“ I do a lot of work with African teams. We had a visitor from Zambia and one of the many things he was learning was this kind of drone imagery processing. It's relatively inexpensive, but high quality. I was training him on how to take the raw images from the drone and make 3D models, then extract the data. His team is now applying these methods in Zambia. There has definitely been a continuation of these technological and educational objectives.”

—Travis Parker, Graduate Student Grantee

SUSTAINABILITY IMPACTS

Legumes are a nutrient-dense plant-based protein source that hold promise for addressing climate change. They emit fewer greenhouse gases compared to other nitrogen-fertilized crops and provide sources of protein for humans, allow more sequestration of carbon in soils, and save fossil energy inputs in the system by reducing fertilizer needs. The varieties were selected for maximum yield in the hot, dry climate of Davis, California and other western field sites, and they have shown strong resilience to these adverse climate factors. Uptake of Parker's varieties in the US and abroad promotes environmental sustainability and a climate-resilient future. Moreover, farmers and food industry members are growing the beans at scale and selling them online, contributing to production and economic sustainability in the form of reduced input costs (associated with weeding), higher crop yields, and economic profit.

BARRIERS

Parker's grassroots approach is not revenue-generating; anyone can use and reproduce the varieties he has created without paying a fee. Moreover, heirloom breeding programs are challenging to fund, as the varieties they produce are viewed as “specialty” items that cannot be produced affordably and distributed at volume. At this time, Parker is not funded to do organic breeding research and is engaging in other lines of inquiry supported by project-specific grants.

FUNDING BREEDING WORK IS A CHALLENGE

“ I think that we often have more difficulty in getting funding for some of our projects, outside of grants, because everybody growing beans is working on such a tight margin that it's harder for them to spare money for breeding work.”

— Travis Parker, Graduate Student Grantee

CONTRIBUTORS

SARE FUNDING WAS INSTRUMENTAL IN PURCHASING UAV EQUIPMENT

“ The SARE funding was extremely useful. It helped immensely with the trialing that we did. A lot of the equipment that we bought, we still use today... we paid for the thermal camera from the SARE grant, which has helped us to understand plant water use that is so important for sustainable agriculture in western states... That thermal camera was a pretty major expense and we continue to use it regularly.”

— Travis Parker, Graduate Student

Parker applied grass roots methods to distribute the new seed varieties, attending the Organic Seed Growers Conference in 2020, which attracts growers across North America and beyond, the California Seed Summit in 2020 and 2023, and a UC Davis picnic day in 2023. From his booth at these events, Parker distributed well over 1,000 free seed packets to attendees. He also shipped seeds to individual farmers who requested them and now has an informal partnership with a participating farmer to sell seed to interested growers. Based on frequent communication with growers and researchers, as well as survey responses submitted by growers, Parker learned that they were successfully cultivating the new varieties across a range of environments.



Training a visiting African researcher to use drone equipment purchased during the SARE grant. Credit: Travis Parker



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