

Agricultural Experiment Station

College of Agricultural Sciences

Department of Soil & Crop Sciences

Extension

Making Better Decisions



**2020 Colorado
Dry Bean
Variety
Performance
Trials**

Crops
Testing

Table of Contents

Authors.....	3
Acknowledgments.....	3
2020 Colorado Dry Bean Performance Trials.....	4
2020 Irrigated Pinto Bean Variety Performance Trial at Lucerne.....	6
2020 Lucerne Bean Trial Variety Descriptions.....	7
Cowpea: A climate-resilient legume that can outperform other legumes under Colorado dryland conditions.....	10

For the fastest access to up-to-date variety information and results visit us at:
www.csucrops.com

Disclaimer

**Mention of a trademark proprietary product does not constitute endorsement by the Colorado Agricultural Experiment Station.
Colorado State University is an equal opportunity/affirmative action institution and complies with all Federal and Colorado State laws, regulations, and executive orders regarding affirmative action requirements in all programs. The Office of Equal Opportunity is located in 101 Student Services. In order to assist Colorado State University in meeting its affirmative action responsibilities, ethnic minorities, women, and other protected class members are encouraged to apply and to so identify themselves.

Authors

Dr. Jerry Johnson - Professor and Extension Specialist - Crop Production, Colorado State University, Dept. of Soil and Crop Sciences, Phone: 970-491-1454,
E-mail: jerry.johnson@colostate.edu

Sally Jones-Diamond - Research Agronomist - Crops Testing Program, Colorado State University, Dept. of Soil and Crop Sciences, Phone: 970-214-4611,
E-mail: sally.jones@colostate.edu

Ed Asfeld - Research Associate - Crops Testing Program, Colorado State University, Dept. of Soil and Crop Sciences, Phone: 970-554-0980, E-mail: ed.asfeld@colostate.edu

Danica Kluth - Graduate Research Assistant- Crops Testing Program, Colorado State University, Dept. of Soil and Crop Sciences, E-mail: Danica.kluth@colostate.edu

Dr. Maria Muñoz-Amatriain - Assistant Professor, Colorado State University, Department of Soil and Crop Sciences, Phone: 970-491-3691, E-mail: Maria.Munoz_Amatriain@colostate.edu

Acknowledgments

The Colorado State University dry bean improvement team wishes to express their gratitude to our 2020 collaborating farmer, Ed Croissant at Lucerne who voluntarily and generously contributed the use of his land, equipment, and time to facilitate the dry bean variety trial. We are also thankful to Larry Lande and Dean Larsen from Northern Feed and Bean in Lucerne for their unflagging collaboration. This trial is evidence of bean check off dollars at work. It would not be possible without research support provided by the Colorado Dry Bean Administrative Committee and Colorado State University.

2020 Colorado Dry Bean Performance Trials

The Colorado State University Crops Testing Program provides unbiased, current, and reliable variety performance results and information to help Colorado dry bean producers make better planting decisions. Our dry bean variety trial serves to test public varieties alongside commercially available varieties. Colorado State University promotes crop variety testing as a service to crop producers and seed companies who depend on us for crop variety performance information.

Dry bean production for 2020 is forecast at 1,091,000 hundredweight, up 75 percent from the 623,000 hundredweight produced a year earlier. Yields are expected to average 2,020 pounds per acre, up almost 200 pounds per acre from last year. Growers expect to harvest 54,000 acres this year, up significantly from the 33,800 acres harvested last year. As of October 11, Colorado's dry bean harvest was estimated to be 58 percent.

One eastern Colorado pinto bean trial was planted, under irrigation, at Lucerne in 2020. Twenty-eight varieties with diverse origins, maturities, disease resistance, growth habits, and adaptability were tested at the irrigated trial location. Trial results are statistically analyzed and reported shortly after harvest on our website on the respective crop page at www.csucrops.agsci.colostate.edu.

Testing Methods

Varieties were included in the test based on paid company entries where company representatives select and enter varieties and provide seed for planting. Sometimes check varieties are included at the request of the relevant state commodity group board, or at our discretion based on past performance for certain varieties.

All trial entries are randomized within each of three replications within the field trial area. Plot sizes are 4-rows wide (30" spacing) by 35' long. Cultural practices for each trial location are included below the individual site tables and practices in the trial area match the rest of the grower's field in most cases.

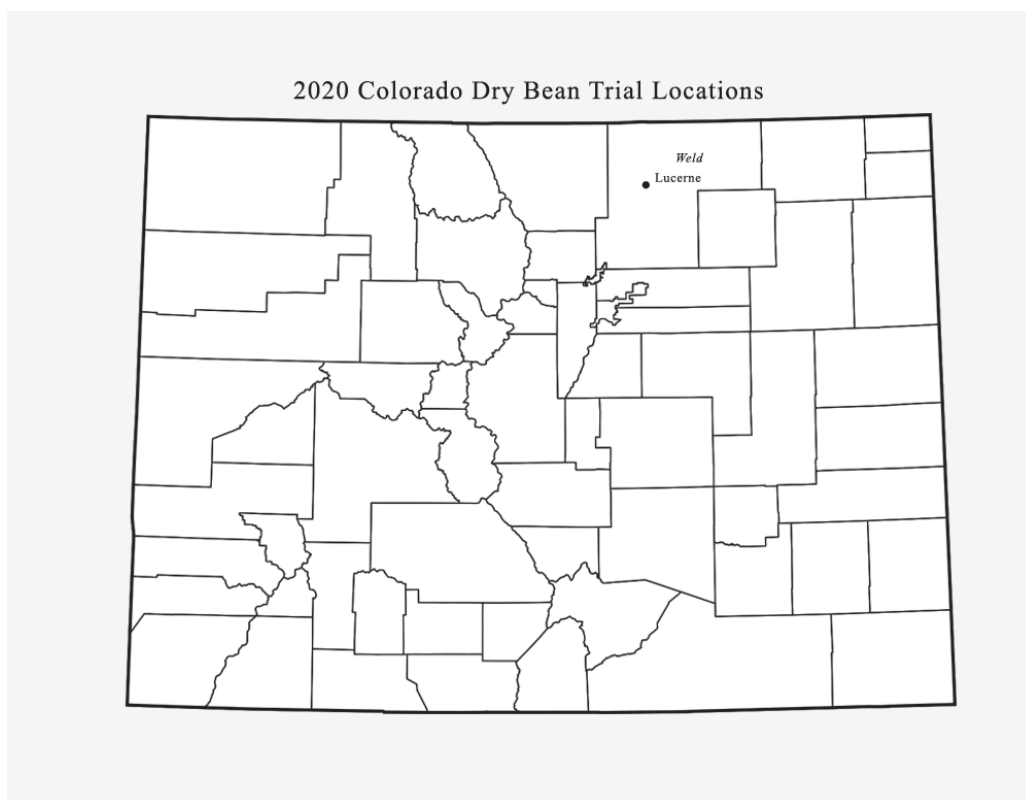
Plots are planted using a four-row Seed Research Equipment Solutions (SRES) 2013 Classic Aire small-plot vacuum planter equipped with a Monosem seed meters. All varieties were planted at a rate of 85,000 seeds per acre.

Dry bean plots were knifed and then harvested using a Case IH 1620 combine modified for small-plots and equipped with a H2 GrainGage weighing system (provides weight, moisture, and test weight). Yield is calculated and adjusted to 14% moisture content.

Data Results

The least significant difference (LSD) is provided at the bottom of the results table. The LSD is used to help determine whether the difference in variety yields are statistically significant. If the difference between variety yields equal or exceed the LSD value, there is a 70% chance (at $P < 0.30$) the difference is statistically significant. If two entries being compared have a difference in yield that is less than the LSD value, those two entries are to be considered equal yielding. Variety yields in bold are in the top LSD group. Varieties in the table are sorted from highest to lowest-yielding.

Variety selection may be based on more than yield performance. Other factors to consider when selecting a variety may include maturity, disease resistance, plant stature, and seed quality.





2020 Irrigated Pinto Dry Bean Variety Performance Results at Lucerne

Variety	Source	Yield ^a	3-Year Avg. Yield	3-Year Avg. Yield	Moisture	Traits	Maturity	Seeds/Pound
		lb/ac	lb/ac	percent of avg.	percent			
PT16-9	USDA-ARS, Prosser, WA	3255	3631	119%	12.0	Slow Dark	Late	1253
PT16-12-1	USDA-ARS, Prosser, WA	3073	-	-	11.3	Slow Dark	Late	1327
Monterrey	ADM Seedwest	3038	3523	115%	11.2	-	Late	1334
DR Wood	Colorado State University	2985	3121	102%	12.3	-	Medium	1221
La Paz	ADM Seedwest	2947	-	-	11.2	-	Late	1279
GTS-904	Genetc, Inc.	2768	3297	108%	11.0	-	Late	1151
StayBright	Trinidad-Benham	2717	3359	110%	12.6	Slow Dark	Late	1342
PT11-13-31	USDA-ARS, Prosser, WA	2699	-	-	11.3	-	Late	1291
Gleam	ADM Seedwest	2636	-	-	11.4	Slow Dark	Late	1257
PT11-13-1	USDA-ARS, Prosser, WA	2609	3206	105%	11.0	-	Medium	1335
Centennial	Colorado State University	2575	2973	97%	11.6	-	Medium	1226
NE2-17-18	University of Nebraska	2563	-	-	11.5	Slow Dark	Medium	1038
ND-Falcon	North Dakota State University	2529	-	-	10.9	-	Late	1325
NE2-17-37	University of Nebraska	2511	-	-	11.8	Slow Dark	Early	1310
Long's Peak	Colorado State University	2446	2817	92%	11.9	-	Medium	1302
Poncho	Rogers/Syngenta Seeds	2337	-	-	10.9	-	Early	1211
Cowboy	ADM Seedwest	2312	2989	98%	11.0	-	Medium	1302
SV6139GR	Seminis	2254	-	-	10.9	-	Medium	1350
Windbreaker	Trinidad-Benham/Seminis	2230	-	-	11.5	-	Early	1161
Lumen	ADM Seedwest	2203	-	-	12.1	Slow Dark	Early	1264
Torreon	ADM Seedwest	2158	2857	93%	11.9	-	Medium	1226
Radiant	ADM Seedwest	2149	2675	87%	10.3	Slow Dark	Early	1273
NE4-17-6	University of Nebraska	2128	-	-	12.3	Slow Dark	Medium	1168
Vibrant	ADM Seedwest	2124	2846	93%	11.0	Slow Dark	Medium	1328
Island	Ag. and Agri-Food Canada	1904	-	-	11.6	-	Early	1302
Rough Rider	Trinidad-Benham	1838	-	-	12.8	-	Medium	1208
ND-Palomino	North Dakota State University	1813	2509	82%	11.8	Slow Dark	Medium	1281
NE4-17-10	University of Nebraska	1708	-	-	12.4	Slow Dark	Medium	1217
Average		2447	3062		11.5			1260

^bLSD (P<0.30)

201

^aYields corrected to 14% moisture.

^bIf the difference between two variety yields equals or exceeds the LSD value, there is a 70% chance the difference is statistically significant. Variety yields in bold are in the top LSD group.

Plot Size: 10' x 30'

Site Information

Collaborator: Ed Croissant
Planting Date: May 28, 2020
Harvest Date: September 21, 2020
Fertilizer: N at 100, P at 40, and K at 30 lb/ac
Soil Type: Weld loam
Herbicides: Eptam at 2 qt/ac and Dual at 0.5 pt/ac
Fungicide: Copper 3L sprayed twice for white mold

This table may be reproduced only in its entirety.

2020 Lucerne Bean Trial Variety Descriptions

Centennial is a 2015 release by Colorado State University. It has resistance to common rust and bean common mosaic virus, excellent seed quality, and semi-upright architecture. It possesses the Ur-3 and Ur-6 alleles that condition resistance to strains of rust found in the High Plains and western US. It is 95 to 100 days to maturity. Yield is 97% of 3-yr trial average yields at Lucerne.

Cowboy is an ADM Seedwest variety from ProVita, and is upright, medium width, short vine, BCMV (bean common mosaic virus) resistant, and resistant to rust strains commonly found in CSU rust trial. Yield is 98% of 3-yr trial average yields at Lucerne.

DR Wood is a 2018 release from Colorado State University. It is a full season variety, 97 to 100 days to maturity with semi-upright architecture (Type II). It possesses disease resistance alleles for resistance to US strains of BCMV and BCMNV (bean common mosaic necrosis virus). resistance to endemic strains of bean common bacterial blight, and resistance to all endemic strains of foliar rust in the Central High Plains and western US. Yield is 102% of 3-yr trial average yields at Lucerne.

Gleam is a medium maturity, slow darkening pinto variety marketed by ADM Seedwest developed by Pro-Vita. It has an erect growth habit and indeterminate growth with medium width, short vine, BCMV (bean common mosaic virus) resistant, and resistant to rust strains.

GTS-904 is a Gentec, Inc. variety. It is a tall, semi-determinate bush plant that holds pods off the ground and has fair to good lodging resistance. It has an upright growth habit which could be suitable for direct harvest. It is a mid-to-full season variety. Yield is 108% of 3-yr trial average yields at Lucerne.

Island was developed at the Agriculture and Agri-Food Canada (AAFC) Research Centre, Lethbridge, AB, in collaboration with the AAFC Research Station, Morden, MB. It is a high-yielding, tall, large-seeded, partially upright pinto common bean with reduced susceptibility to white mold.

La Paz is an AmeriSeed variety distributed by Seedwest, is an upright medium to narrow profile variety that holds its pods off the ground, lending itself to direct harvest. The plant has an erect growth pattern and indeterminate short runners with bean common mosaic virus and bean rust disease resistance.

Long's Peak is a 2011 release from Colorado State University. It has excellent seed color; resistance to prevalent strains of rust in the High Plains, and resistance to BCMV and BCMNV. Rust resistance is derived from a single recessive gene that allows small rust pustules to form on the leaves late in the growing season. Long's Peak has upright plant architecture in most environments and medium plant maturity (94-98 days). Yield is 92% of 3-yr trial average yields at Lucerne.

Lumen is a medium maturity, slow darkening pinto variety marketed by ADM Seedwest developed by Pro-Vita, that is slow darkening. It has an erect growth habit and indeterminate growth with medium width, short vine, BCMV (bean common mosaic virus) resistant, and resistant to rust strains.

Monterrey is an ADM Southwest variety from ProVita and it is a upright, broad, short vine, BCMV resistant, and resistant to strains commonly found in the CSU rust trial. Medium early maturity. Yield is 115% of 3-yr trial average yields at Lucerne.

ND Falcon is a North Dakota State University release with upright architecture (type IIa) with short vines. Under North Dakota conditions it matures in approximately 105 days. It is resistant to the new race of rust (20-3) predominant in the region and BCMV. It shows resistance to Soybean Cyst Nematode and has agronomic traits of economic importance such as canning quality and seed shape/size are within commercially acceptable ranges.

ND Palomino is a slow darkening variety derived from the cross Santa Fe/PS08-108. It has an upright, indeterminate (short vine) growth habit (Type 2A), white flowers, and matures in approximately 102 days. It is resistant to BCMV, but susceptible to both rust and anthracnose diseases. It was found acceptable in canning tests performed by two major canning companies, but they warned against mixing/comingling regular darkening with slow darkening beans in the same canning line because the final color of the beans will be very different. Yield was 82% of 3-yr trial average yields at Lucerne.

Poncho is a medium maturity (97 day) pinto variety released by Rogers/Syngenta Seeds, Inc. in 1998 with resistance to BCMV, and has excellent seed quality. It has Type III growth habit. It is susceptible to rust and bacterial brown spot.

Radiant is a slow darkening ADM Seedwest variety from ProVita. It is an indeterminate plant that is upright in architecture. It is about three days later in maturity when compared to Poncho. It is resistant to rust and BCMV. Yield was 87% of 3-yr trial average yields at Lucerne.

Rough Rider (SV6533GR) is an early semi-determinate pinto variety developed by Seminis and marketed by Trinidad-Benham. It is an upright plant type and has good yield potential. The variety has superior lodging resistance and similar seed size to Windbreaker with very good pod placement with improved quality. It has disease resistance to bean common mosaic virus and bean rust.

StayBright is a slow-darkening pinto variety released by Colorado State University and marketed by Trinidad-Benham. The slow darkening allele was derived from the germplasm line SDIP-1 by the University of Idaho in 2006. It is resistant to endemic strains of foliar rust in the High Plains and all strains of BCMV. It has semi-upright architecture. Harvest maturity is 96 to 99 days in the High Plains region.

SV6139GR is a variety released by Seminis with an upright, semi-determinate plant growth habit with good pod position making it suitable for direct combining. It has good yield potential and improved lodging resistance with a broad adaptation and possesses disease resistance to bean common mosaic virus and bean rust.

Torreón is an ADM Seedwest variety from ProVita. It has medium maturity and an upright short vine architecture. It is medium width, BCMV resistant, and resistant to rust strains commonly found in CSU rust trial. Yield was 93% of 3-yr trial average yields at Lucerne.

Vibrant is a slow darkening ADM Seedwest variety from ProVita. It is indeterminate and has upright plant architecture. Its maturity is approximately 99 days. It is resistant to rust and BCMV. Yield was 93% of 3-yr trial average yields at Lucerne.

Windbreaker is a variety released by Seminis and currently marketed by Jack's Bean. It is an indeterminate mid-season (94 to 98 day) pinto bean with upright, short-vine growth habit. It has resistance to BCMV and rust.

Experimentals

NE2-17-37, NE4-17-6, and NE4-17-10 are slow darkening pinto lines from the University of Nebraska that are being considered for release. They have resistance to BCMV and common rust and intermediate resistance to CBB. They exhibit broader adaptation. All have an upright plant architecture (Type 2b) and medium maturity.

NE2-17-18 is a slow darkening pinto line from the University of Nebraska that is being released as a cultivar. It has resistance to BCMV and common rust and intermediate resistance to CBB. It exhibits broader adaptation and is being tested in 16 experiments across the U.S. It has a semi-upright plant architecture and full season maturity.

PT16-9 and **PT16-12-1** are slow darkening pinto bean sister lines from USDA-ARS, Prosser, WA, that are being considered for release as cultivars. Both have resistance to BCMV and rust, exhibit broad adaptation, and perform well under stressful conditions including low soil fertility and drought. They have upright growth habit, with PT16-12-1 a bit more upright but a day or two later than PT16-9.

PT11-13-1 and **PT11-13-31** are advanced pinto bean sister lines from USDA-ARS, Prosser, WA, that are being considered for release as cultivars. They have resistance to BCMV (I + bc-3 genes) and rust (Ur-3 and Ur-11 genes), exhibit broad adaptation, and perform well under stressful conditions including low soil fertility and drought. They have semi-upright growth habit and medium maturity. Both are sensitive to white mold but PT11-13-31 is slightly less sensitive.

Cowpea

A climate-resilient legume that can outperform other legumes under Colorado dryland conditions

Cowpea (*Vigna unguiculata*), an ancient crop originated in Africa, is well known for its adaptation to drought, heat, and poor soils. Although most cowpeas grown in the U.S. are black-eyed peas, great diversity of seed colors and patterns exists within cowpea (Figure 1). Cowpea varieties



Figure 1. Diversity of seed types in cowpea. Photo credit: Jeffrey Ehlers.

also have diverse growth habits, with bush types being best suited for direct harvest and dry seed production, and vining types being preferred for intercropping, forage or cover crop use.

Historically, cowpea research data together with current experience of several cowpea growers in Colorado indicates that cowpea has enormous potential as an alternative crop for dryland systems in the state. As a rotation crop, cowpea could become an important part of dryland cropping systems, preventing soil erosion, and providing nitrogen to fall-planted crops including winter wheat. In such systems, it could be utilized for different purposes (seed, forage,

green manure) depending on seasonal weather patterns, improving farmer risk management. Despite its potential as an alternative crop to improve Colorado cropping systems, only a few varieties have been tested to date: mostly California varieties, CB5 and CB46.

At Colorado State University, Dr. Maria Munoz-Amatriain obtained a collection of 368 varieties from all over the world which were planted at CSU's Agricultural Research, Development and Education Center (ARDEC) in summer 2019 under well-watered and rainfall-only conditions. Although the severe damage caused by the 2019 hailstorm made it impossible to collect yield data from those plots, observations for flowering time, plant architecture and yield performance were taken. Based on those observation, 19 varieties (mostly black-eyed peas) were selected to conduct replicated field trials in the summer of 2020 at the at the USDA-ARS Central Great Plains Resources Management station in Akron under dryland conditions.

Cowpea varieties were planted in Akron on May 27, 2020 with some fallow plots as a control. Common beans (Pinto beans) were planted at the end of that same field. No fertilizer was applied, but Spartan Elite was applied to the field on May 29. Overall, this was a very harsh cropping season for dryland agricultural systems. A hailstorm with winds over 100 mph hit the Akron station on June 10, causing damage to the cowpea and bean seedlings that had emerged. In addition, this was one of the driest summers on record with a total rainfall at the station of 2.8" for the entire crop season. Nevertheless, all cowpea varieties outperformed Pinto beans (see Figure 2), which produced no measurable yield. The average cowpea yield was 728 lb/ac. However, there were significant differences between cowpea varieties, with average yields ranging from 240 lb/ac for the Nigerian variety "IT93K-452-1" to 1,188 lb/ac for the Portuguese variety "Cp 4906" and 1,127 lb/ac for "TVu-1811", a variety from Puerto Rico. Yield of CB46, one of the most widely grown varieties in Colorado, averaged 790 lb/ac under those conditions. This

indicates there are available cowpea varieties that can potentially outperform the Californian black-eyed varieties in Colorado dryland systems, and that breeding for higher grain yield is possible.

The cowpea trial was harvested on August 28, 2020, and winter wheat was planted on that same field on September 18. The effect of cowpea varieties relative to fallow on wheat yield and quality will be evaluated, providing insights into the potential use of cowpea as a fallow replacement crop. This would have a positive impact on the sustainability and profitability of wheat-based dryland systems. In addition, over 300 cowpea varieties from Dr. Munoz-Amatriain's collection were planted at ARDEC in the summer of 2020 under irrigated and dryland conditions. The dryland part of the field only received 1.74" of rainfall for the entire cropping season (June 5 – September 6, 2020). Seed from those varieties is being processed and yields will be calculated, which will inform of potential new cowpeas adapted to irrigated and/or dryland conditions in the state.

In summary, due to its resilience and versatility cowpea shows promise as a great alternative crop for improving the profitability of Colorado cropping systems as well as soil and human health.



Figure 2. Cowpeas (top) and common beans (bottom) growing in Akron on August 3, 2020



COLORADO STATE UNIVERSITY
EXTENSION

Crops
Testing

Department of Soil and Crop Sciences
1170 Campus Delivery
Fort Collins, CO 80523-1170

Jerry Johnson, Extension Specialist Crop Production



Find us on Twitter: [@csucrops](https://twitter.com/csucrops)