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Agricultural

Experiment Station

Colorado State University

College of Agricultural Sciences Department of Soil & Crop Sciences Extension

Making Better Decisions

2023 Colorado Dry Bean Variety Performance Trials

Crops Testing

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2023 Colorado Dry Bean and Cowpea Performance Trials

Sally Jones-Diamond

The Colorado State University Crops Testing Program provides unbiased, current, and reliable research results and information to help Colorado dry bean producers make better decisions. Colorado State University promotes crop variety and agronomy testing as a service to crop producers and seed companies who depend on us for crop performance information.

Colorado State University personnel planted two irrigated pinto bean sites and two dryland and one irrigated cowpea trial in northeast Colorado. Irrigated pinto bean trial locations were Kirk and Yuma. The irrigated site at Yuma included two separate pinto trials. The trials were 1) a strip trial containing six varieties chosen by bean processors and funded by the Colorado Dry Bean Committee and 2) a small plot trial with thirteen varieties from various public and private breeding programs entered at will. The irrigated site at Kirk included a small plot variety trial, with the same varieties that were tested at the Yuma site. The dryland and irrigated cowpea trials were located in Akron at the USDA-ARS Central Great Plains Research Center. The dryland cowpea trials consisted of a variety trial and a microbiologicals product trial. The dry bean trials at Yuma were destroyed due to hail in August. The other trials were harvested and statistically analyzed and reported after harvest on our website at csucrops.com.

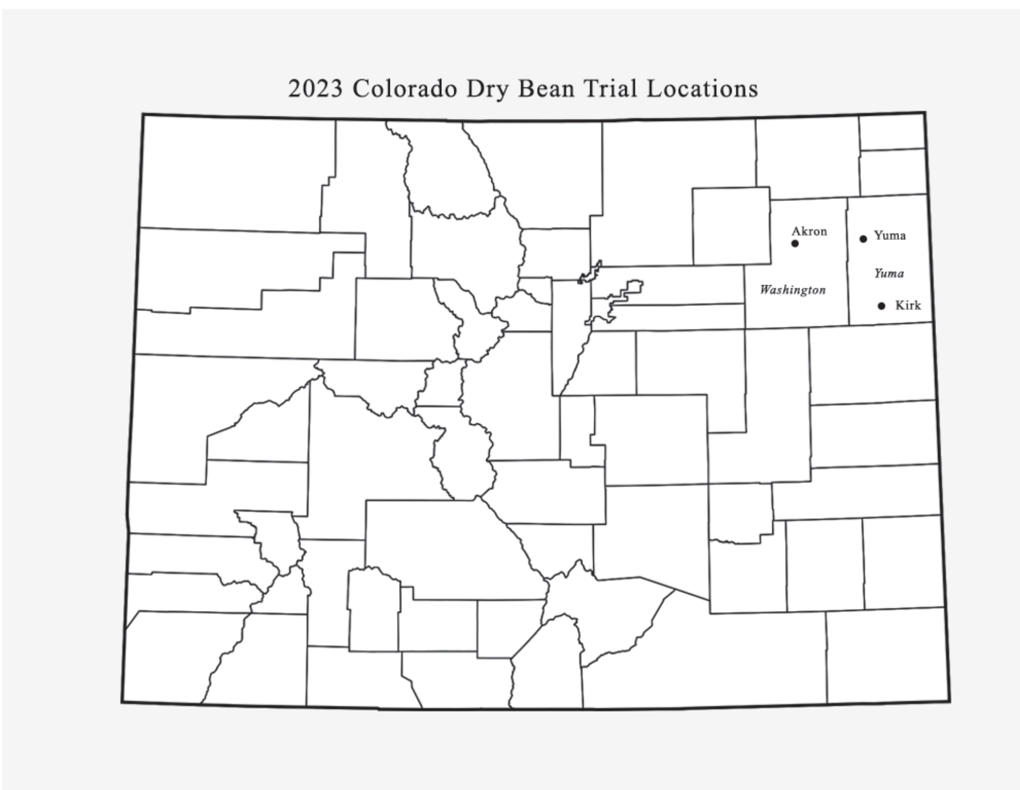
Variety Trial (Small Plot and Strip) Testing Methods

All trial entries were randomized within each replication using a randomized complete block design. Plot sizes for the small plot dry bean trials were four rows wide (10 feet) by 30 feet long. The strip trial plots were four rows wide (10 feet) by at least 140 feet long. The dryland and irrigated cowpea trial plot sizes were two rows wide (5 feet) by 30 feet long harvested. All irrigated trials were irrigated using overhead sprinklers (pivot or linear move). Varieties in the trials were replicated three times within each location and trial. Cultural practices for each trial location are included below the individual site tables when available. Management practices generally match the rest of the producer's field. None of the beans in the variety trials were inoculated.

All plots were planted using a four row Seed Research Equipment Solutions (SRES) 2013 Classic Aire vacuum planter equipped with Monosem seed meters. Irrigated pinto bean trials were planted at 85,000 seeds per acre. The dryland cowpea trial was planted at 61,500 seeds per acre. The irrigated cowpea trial was planted at 98,750 seeds per acre. Dry bean plots were harvested using a Case IH 1620 combine modified for small plot use and equipped with a H2 GrainGage weighing system and a flex header. Cowpea plots were harvested using a Wintersteiger Classic combine and harvested plot seed was bagged and weighed. Seed was analyzed on a GAC 2500-AGRI to obtain test weight and moisture values the day of harvest.

Interpreting Results

The least significant difference (LSD) is provided at the bottom of the yield tables. The LSD is used to help determine whether differences in variety yield are statistically significant. If the yield difference between two varieties equals or exceeds the LSD value, the difference between them is significant. When both an LSD ($P<0.30$) and LSD ($P<0.05$) are provided, farmers should use the LSD (0.30) for selecting superior varieties to minimize economic loss due to false negative results (concluding there is no difference when there is one). Others may use LSD (0.05) to minimize the risk of false positive results (concluding there is a difference when there isn't one). A farmer may want to use an LSD (0.05) if a management treatment is being compared to a control treatment. If two varieties being compared have a difference in yield that is less than the LSD value, those two varieties are considered equal yielding. Variety yields in bold in the tables are in the top LSD yield group and are equal yielding. Variety selection may be based on more than yield performance. Other factors to consider when selecting a variety includes maturity, disease resistance, plant architecture, seed quality, and cost.



2023 Irrigated Pinto Bean Variety Performance Trial at Kirk

Variety	Source	Traits	Yield[a]	2-Year Yield	Test Weight	Seeds/Pound	Moisture	Maturity
			lb/ac	average	lb/bu		percent	days after planting
USDA Cody	USDA-ARS, Prosser, WA	-	**4285**	-	61	1172	13	87
ND Palomino	North Dakota State Univ.	Slow-Dark	**3943**	3074	60	1077	22	90
PT22-7	USDA-ARS, Prosser, WA	-	**3934**	-	60	1105	21	88
USDA Rattler	Kelley Bean	-	**3917**	3646	60	1042	14	88
Charro	Michigan State Univ.	-	3849	3331	61	1070	23	90
ND Rodeo	North Dakota State Univ.	Slow-Dark	3774	-	62	997	23	90
USDA Diamondback	Kelley Bean	Slow-Dark	3629	-	61	1057	21	88
PT22-8	USDA-ARS, Prosser, WA	-	3584	-	60	1106	18	87
SV6139GR	Seminis	-	3510	-	62	1169	13	82
ND Falcon	North Dakota State Univ.	-	3506	2924	59	1171	14	91
NE2-22-12	Univ. of Nebraska-Lincoln	-	3376	-	61	970	20	89
NE2-21-41	Univ. of Nebraska-Lincoln	-	3125	-	62	1079	13	84
USDA Basin	USDA-ARS, Prosser, WA	-	2855	2531	59	1105	22	88
		Average	**3637**	**3101**	**61**	**1086**	**18**	**88**
		[b]LSD (0.30)	379					
		[b]LSD (0.05)	734					
		Coeffecient of Variation (CV)	12.8					

[a]Yields corrected to 14% moisture.

[b]If the difference between varieties is equal to or greater than the LSD value, the chance the difference is significant is 70% (for LSD 0.30). There were no statistically significant differences at the 0.05 level. Farmers selecting a hybrid based on yield should use the LSD (.30) to protect themselves from false negative conclusions (concluding hybrids are the same when they are actually different). Companies or researchers may use LSD (.05) to avoid false positive conclusions (concluding hybrids are different when they are actually the same).

Site Information

Collaborator: TK Farms
Planting Date: June 21, 2023
Harvest Date: September 30, 2023
Soil Type: Haxtun sandy loam
GPS Coordinates: 39.598833, -102.465873
Trial Comments: Trial initially planted on June 8 and then replanted on the 21 due to poor emergence from crusting. Replanted beans had excellent emergence and plant stands. Good weed control throughout the season. Desiccant sprayed a week prior to harvest. All plots were direct-harvested with a combine equipped with a flex-header.

Contact Sally Jones-Diamond (sally.jones@colostate.edu)

2023 Pinto Bean Variety Descriptions

Charro is a variety released by Michigan State University AgBioResearch as a high-yielding, upright, full-season cultivar with excellent canning quality. It has the I-gene that confers resistance to BCMV and BCMNV and was resistant to rust race 31:7 in the CSU rust nursery. Maturity is 97 days on average.

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 jointly released by North Dakota State University and the USDA-ARS. 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.

ND Rodeo is a slow darkening variety released by North Dakota State University. 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 local ND races of both rust and anthracnose pathogens.

SV6139GR is a variety released by Seminis with an upright, semi-determinate plant growth habit and 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.

USDA Basin is a variety released by USDA-ARS with license to a seed company pending. It has resistance to potyvirus (BCMV) and bean rust. It performs well under lower fertility conditions. It has semi-upright architecture and moderate resistance to lodging. Around 96 days to maturity.

USDA Cody is a variety released by USDA-ARS and licensed to Kelley Bean Co. It has resistance to potyvirus (BCMV and BCMNV) and bean rust. It performs well under drought and low soil fertility conditions. It has upright architecture and resistance to lodging. Around 98 days to maturity.

USDA Diamondback (PT16-9) is a variety released by USDA-ARS and licensed to Kelley Bean Co. It has slow darkening seed coat. It has resistance to potyvirus (BCMV and BCMNV) and bean rust. It performs well under drought and low soil fertility conditions. It has upright architecture and resistance to lodging. Around 97 days to maturity.

USDA Rattler is a variety released by USDA-ARS and licensed to Kelley Bean Co. It has resistance to potyvirus (BCMV and BCMNV) and bean rust. It performs well under drought and low soil fertility conditions. It has upright architecture and resistance to lodging. Around 97 days to maturity.

Experimentals

NE2-22-12 and **NE2-21-41** are pinto lines from the University of Nebraska that are being considered for release.

PT22-7 is a breeding line from USDA-ARS. It performs well under drought and has resistance to potyvirus (BCMV and BCMNV). It exhibits upright architecture and resistance to lodging. Around 94 day maturity

PT22-8 is a breeding line from USDA-ARS. It performs well under drought and has resistance to potyvirus (BCMV and BCMNV). It exhibits upright architecture and resistance to lodging. Around 95 day maturity. Note that PT22-7 and PT22-8 are sister lines.

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2023 Dryland Cowpea Variety Performance Trial at Akron

Variety or Accession	Origin	Yield[a]	Test Weight	Moisture
		lb/ac	lb/bu	percent
524-B	USA, California	906	55	10
UCR 24	USA	722	54	10
TVu-14253	Botswana	717	61	11
CB46	USA, California	706	57	10
CB5	USA, California	701	54	10
Gorda	Puerto Rico	669	56	10
UCR 5385	Italy	620	63	10
CB27	USA, California	616	54	10
Vg50	Portugal	547	57	10
Cp 5556	Portugal	538	54	10
1393-1-2-3(-)	USA, California	465	53	10
Vg72	Portugal	406	53	10
UCR 5275	Australia	375	53	10
Cp 4906	Portugal	347	52	10
	Average	**595**	**55**	**10**
	[b]LSD (0.05)	NS		

[a]Yields corrected to 14% moisture.

[b]Trial could not be statistically analyzed due to plot variation caused by early season hail damage. Average yields reported above are only trends and varieties should not be considered different from each other.

<u>Site Information</u>

Collaborator:	Central Great Plains USDA-ARS Station
Planting Date:	June 20, 2023
Harvest Date:	October 10, 2023
Herbicides:	Pre-Plant Burndown: Sharpen at 1 oz/ac and Roundup at 24 oz/ac Post-Emerge: Raptor at 4 oz/ac and Basagran at 8 oz/ac on Aug. 4th
Soil Type:	Rago silt loam
Trial Comments:	Trial planted into excellent moisture. Good emergence, but early season hail reduced stands. Radar estimates showed the trial received about 10.2 inches of rain from planting to harvest and 21.8 inches since January 1st, which is 140% of the ten-year average (year-to-date).

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2023 Dryland Cowpea
Microbiological Product Trial at Akron

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Company	Application Type	Treatments	Yield[a]	Test Weight	Moisture
			bu/ac	lb/bu	percent
None	*n/a*	*Untreated Control*	*686*	*56*	*10.1*
Van Grow	Liquid In-Furrow	ACL-5000	754	57	10.2
None	*n/a*	*Untreated Control*	*686*	*56*	*10.1*
Van Grow	Dry In-Furrow	ACB-5000	638	56	10.2
None	*n/a*	*Untreated Control*	*686*	*56*	*10.1*
Indigo Ag	Seed Treatment	M34	610	56	10.1
None	*n/a*	*Untreated Control*	*686*	*56*	*10.1*
Van Grow	Liquid In-Furrow	AC-5000	606	57	10.2
		Average	**659**	**56**	**10.1**
		Replicates	6		
		[b]LSD (0.05)	NS		
		Coefficient of Variation (CV)	13.7		
		Available Nitrate-N (lb/ac top 2 feet)	22		
		Organic Matter Content (%)	1.3		
		Soil pH in top foot	6.3		

[a]Yield corrected to 14% moisture.

[b]An LSD (alpha 0.05) has been used to minimize the risk of false positive results, or concluding there is a difference when one doesn't exist. Treatment yields were not statistically different from the control.

Site Information

Collaborator:	Central Great Plains USDA-ARS Station
Planting Date:	June 20, 2023
Harvest Date:	October 10, 2023
Herbicides:	Pre-Plant Burndown: Sharpen at 1 oz/ac and Roundup at 24 oz/ac Post-Emerge: Raptor at 4 oz/ac and Basagran at 8 oz/ac on Aug. 4th
Soil Type:	Rago silt loam
Trial Comments:	Trial planted into excellent moisture. CB46 variety was used for all treatments. Good emergence, but early season hail reduced stands. Radar estimates showed the trial received about 10.2 inches of rain from planting to harvest and 21.8 inches since January 1st, which is 140% of the ten-year average (year-to-date).

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2023 Irrigated Cowpea Variety Performance Trial at Akron

Variety or Accession	Origin	Yield[a]	Test Weight	Moisture	Flowering	Seeds Per Pound
		lb/ac	lb/bu	percent	days after planting	
524-B	USA, California	**1407**	49	14	59	1424
Gorda	Puerto Rico	**1406**	52	13	61	1608
TVu-14253	Botswana	**1390**	55	14	55	2217
1393-1-2-3(-)	USA, California	**1293**	49	14	59	1485
CB46	USA, California	**1274**	53	13	60	1861
CB5	USA, California	**1256**	50	13	61	1552
Vg72	Portugal	**1241**	53	13	59	2137
UCR 24	USA	1181	49	14	59	1593
Cp 4906	Portugal	1170	48	15	62	1514
Cp 5556	Portugal	1146	51	13	61	1692
UCR 5275	Australia	1098	54	13	60	1750
CB27	USA, California	1096	50	14	58	1793
UCR 5385	Italy	979	58	13	55	2545
	Average	**1226**	**52**	**13**	**59**	**1782**
	Replicates	3	3	3	3	3
	[b]LSD (0.05)	190				
	Coefficient of Variation (CV)	13.7				

[a]Yield corrected to 14% moisture.

[b]An LSD (alpha 0.05) has been used to minimize the risk of false positive results, or concluding there is a difference when one doesn't exist. Varieties in the top yield group are in bold.

Site Information

Collaborator:	Central Great Plains USDA-ARS Station
Planting Date:	June 20, 2023
Harvest Date:	October 4, 2023
Herbicides:	Pre-Emerge: Roundup Pro at 24 oz/ac, Prowl H20 at 3 pt/ac, Spartan at 3 oz/ac, Sharpen at 1 oz/ac, and Vida at 2 oz/ac
Soil Type:	Rago silt loam
Trial Comments:	Trial planted into excellent moisture. Good emergence, but early season hail reduced stands. Trial irrigated three times late in the growing season for a total of 3 inches applied. Radar estimates showed the trial received about 10.2 inches of rain from planting to harvest and 21.8 inches since January 1st, which is 140% of the ten-year average (year-to-date).

Contact Sally Jones-Diamond (sally.jones@colostate.edu)

White Mold Affecting Dry Beans

Emma Barrett and Dr. Robyn Roberts

Background

White mold, a disease caused by the fungal species *Sclerotinia sclerotiorum* and *Sclerotinia trifoliorum*, has become one of the most relevant assailants of dry bean in Colorado and much of the High Plains region (Harveson et al. 2007). It is commonly referred to as Sclerotinia stem rot, watery soft rot, and drop or blossom blight (Agricultural Knowledge Center 2023). Under conditions that support the growth of these fungi, yield losses can range from 40% to 100% (Schwartz et al. 2007), and seed losses can reach 100% (Escobar et al. 2022). Given ever-changing climate conditions and the devastating effects seen in fields affected by white mold, it is important to understand how to recognize, prevent, and mitigate future spread of this disease.

Disease and symptoms

A watery, rotted stem covered in white, fuzzy fungus (**Figure 1**) is characteristic of white mold disease in dry beans (UC IPM 2023). Infections often start with a mushroom-like fruiting structure (apothecium) that emerges from a dark mass of hardened fungi (sclerotia), typically on plant residue (**Figure 2**), which infects stems and causes a water-soaked lesion (UC IPM 2023). White mold, consisting of fuzzy, thread-like extensions (mycelium), eventually covers the lesion (Harveson et al. 2007). This can occur on bean pods, leaves, and stems, and the disease can affect sunflowers, weeds, vegetables, fruit, and snap beans in addition to dry beans (UC IPM 2023). Plants infected with the white mold fungus can exhibit signs of bleached and shredded dead tissue (Harveson et al. 2007). This is seen in **Figure 2** surrounding the dark mass of fungi (sclerotia) on the common bean plant.

Figure 1. Symptoms of white mold on the stems of a dry bean plant. Photo: Howard F. Schwartz, Colorado State University, Bugwood.org.

Figure 2. Hardened, darkened fungal mass (sclerotia) on the stem of a common bean (*Phaseolus vulgaris L.*) plant. Photo: Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org.

Infection and pathogen survival

Some of the key factors in determining the success of *Sclerotinia sp.* in fields include their life stage characteristics, farming practices, and environmental conditions. Seven to ten days of high soil moisture content is ideal for the growth of the apothecia from the sclerotia (Bales and Chilvers 2020). These overwintering and survival structures are hardy and can survive in the soil for long periods of time in harsh environmental conditions for at least three years (Harveson et al. 2007). A local Colorado news station stated in July 2023 that "the last few months have been among the most humid in 20 years on the Front Range and eastern plains" (Reppenhagen 2023), which is conducive to white mold disease development. Further infections from other disease-causing microbes are common under conditions of high humidity and cold temperatures due to susceptible plant tissue that is either deteriorating or dead due to white mold infections (UC IPM 2023). Transmission of white mold can occur through the spread of sclerotia, infected seeds, fungal mycelia in the soil and on plant residue, and airborne spores (Harveson et al. 2007). Measures can be taken to prevent infection by these fungi and there are fungicidal treatment options available for use.

Management

There are many preventative measures that can be taken to manage and control white mold disease. Post-harvest tillage has been associated with reduced white mold presence given that the diseased tissue is buried (Harveson et al. 2007). However, the long survival period of the sclerotia may require treatment in fields where disease losses occur. Wide row spacing and reduced nitrogen application work to reduce plant humidity (UC IPM 2023). More air flow keeps plants drier due to greater spacing between canopies and reduced nitrogen lessens extensive canopy development, which can trap humidity and promote fungal growth. Wet-dry cycles are also helpful for reducing fungal growth (Bales and Chilvers 2020). The amount of rainfall is less important than the frequency of rainfall, given that frequent rainfall is more likely to contribute to white mold growth even in low quantities due to prolonged humidity. These weather patterns should be taken into consideration when irrigating. There are predictive apps on the market, such as Sporecaster (https://ipcm.wisc.edu/apps/sporecaster/), that can estimate the likelihood of white mold given the weather patterns, cropping practices, and irrigation frequency of a particular field (Bales and Chilvers 2020).

Given that white mold generally causes high yield losses, treatment with fungicides such as Benomyl, thiophanate-methyl, and iprodione in a sufficient quantity of water are recommended for fields that have several of the high-risk factors for white mold development (Harveson et al. 2007). A combination of fungicides can often improve treatment outcomes, and the field should be sprayed when 80-90% of the plants have pods or small flowers (Harveson et al. 2007). According to a study carried out at the University of Nebraska, procymidone may be the best fungicide for reducing the formation of the dark mass of fungi from which fruiting bodies sprout, which could help with long-term management of the disease (Miorini et al. 2016). Sporebuster (https://ipcm.wisc.edu/apps/sporebuster/) can be used in conjunction with Sporecaster to help predict when fungicide applications are profitable. Overall, white mold is an economically important disease affecting dry beans, and evaluating field risk factors to make decisions about irrigation and fungicidal application are important considerations that could help mitigate the effects of these fungal infections.

Photos (used with permission):

Howard F. Schwartz, Colorado State University, Bugwood.org. Common bacterial blight affecting pod. IPM Images. https://www.forestryimages.org/browse/detail.cfm?imgnum=1634010.

Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org. IPM Images. https://www.ipmimages.org/browse/detail.cfm?imgnum=5606932.

References:

Harveson R, Steadman J, Schwartz H. 2007. White Mold of Dry Beans. NebGuide. https://extensionpublications.unl.edu/assets/pdf/g1786.pdf.

Agricultural Knowledge Center. 2023. Sclerotinia Diseases. Saskatchewan. https://www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/agribusiness-farmers-and-ranchers/crops-and-irrigation/disease/sclerotinia#:~:text=Sclerotinia%20stem%20rot%2C%20also%20known,minor.

Escobar E, Oladzad A, Simons K, Miklas P, Lee R, Schroder S, Bandillo N, Wunsch M, McClean P, Osorno J. 2022. New genomic regions associated with white mold resistance in dry bean using a MAGIC population. https://doi.org/10.1002/tpg2.20190.

Schwartz H, Gent D, Franc G, Harveson R. 2007. White Mold. High Plains IPM Guide. https://bugwoodcloud.org/bugwoodwiki/WhiteMold-DryBean.pdf.

UC IPM. 2023. White Mold. University of California Integrated Pest Management. https://ipm.ucanr.edu/agriculture/dry-beans/white-mold/.

Bales S, Chilvers M. (2020). White mold management in Michigan dry beans. Michigan State University, MSU Dry Bean Extension. https://www.canr.msu.edu/news/white-mold-management-in-michigan-dry-beans.

Reppenhagen C. 2023. So much for a 'dry heat' as Colorado's high humidity cranks up the summer heat. 9 News Weather Colorado. https://www.9news.com/article/weather/weather-colorado/heat-colorado-high-humidity-summer/73-570c183d-bbe5-416e-b0d9-2131c300fa30#:~:text=DENVER%20%E2%80%94%20Using%20a%20measurement%20of,from%20the%20Gulf%20of%20Mexico.

Miorini, T, Raetano C, Everhart S. 2016. Control of white mold of dry bean and residual activity of fungicides applied by chemigation. Crop Protection 1(94):192-202. doi:10.1016/j.cropro.2016.12.023

Incorporation of Grain Legumes into Irrigated and Dryland Crop Rotations

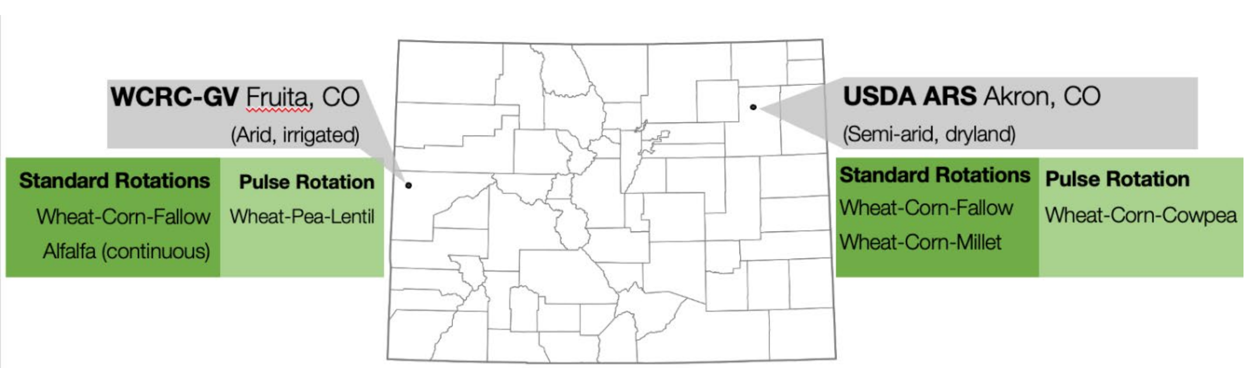
Marissa Spear, Antisar Afkairin, Perry Cabot, Jessica Davis, Jasmine Dillon, Steve Fonte, Dan Mooney, Joel Schneekloth, and Jorge Vivanco

In eastern Colorado, introducing alternative pulse crops (grain legumes) into crop rotations to counter the rising costs of fallow has potential to increase farm profitability and improve soil health while minimizing environmental impact. Western Colorado faces high water demands, and winter pulse crops may reduce input costs while allowing producers to lease their excess water in the summer. Many pulse crops have low water and nutrient requirements, provide soil nutrient cycling benefits, and can provide risk-reducing options, as they can be used for forage or grain.

We received a USDA-ARS Pulse Crop Health Initiative grant in 2022 to trial 3-year alternative pulse crop rotations at sites in eastern and western Colorado and evaluate environmental and economic outcomes compared to wheat rotations with fallow or standard crops. Dryland crop rotation trials are ongoing at the USDA – Central Great Plains Agricultural Research Station in Akron while irrigated crop rotation trials are occurring at the CSU Western Colorado Research Center – Grand Valley (WCRC-GV) in Fruita.

We will quantify the environmental impact of standard rotations and alternative pulse crop rotations by measuring water use, soil health measures including nitrogen cycling and soil organic matter, as well as economic impact by comparing profitability of rotations that contain pulse crops compared to standard rotations. To understand the in-depth environmental impact of these crop rotations and diets that include pulse crops, all inputs from the field to plate will be analyzed using a life cycle analysis approach.

This year, the cowpeas in our Akron fields were planted later than usual in early June due to rain. Harvest occurred in October, in time for wheat planting. Last year, the peas and lentils in Fruita were unable to get established after September planting, but were replanted in February 2023 with deeper planting depth and higher planting density. The re-crops at Fruita struggled due to weed pressure. This year, stronger weed control methods and appropriate planting depth were employed to aid fall crop establishment.



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