Sustainable production practices for edible dry beans

**Investigators:** Jay Norton, Jeremiah Vardiman, Jim Heitholt, Carrie Eberle, and Urszula Norton

**Issue:** Reduction in sugarbeet acres due to increased yields in the Bighorn Basin is facilitating longer rotations that often include edible dry beans, along with transition from furrow irrigation to overhead sprinklers. These changes create opportunities for conservation tillage systems that can reduce erosion and improve soil health; however, current dry bean production systems do not support goals of conservation tillage systems because they include undercutting and windrowing for harvest, removing much of the bean root system from the soil.

**Goal:** Study interactions between conservation tillage, direct bean harvest, soil health, and nitrogen fixation.

**Objectives:**
1. Evaluate effects of a conservation tillage system in a sugarbeet–dry bean–barley rotation on soil and plant health and productivity (particularly on nitrogen fixation by beans); and
2. Develop extension materials and programs that focus on opportunities for including edible dry beans in alternative, conservation-oriented crop rotations.

**Expected Impact:** Results should assist growers in designing soil-building cropping systems that include dry beans in rotations by providing information about how reduced tillage, direct harvest, and variety selection affect bean yields, soil health, and bean nitrogen fixation.

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**Keywords:** dry bean, conservation tillage, soil health

**PARP:** I:8,9,13, II:6,7

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Dry bean water management and yield response under surface and sprinkler irrigation

**Investigators:** Vivek Sharma, Jim Heitholt, and Jeremiah Vardiman

**Issue:** As many Wyoming growers face significant management decisions to conserve irrigation water, many questions need to be addressed, including how to maximize use of available water. Despite the relatively high irrigated dry bean acreage in Wyoming (the state ranks about eighth in the country with ~30,000 harvested acres [2016]), information is lacking when it comes to helping producers plan and operate their irrigation systems, notably short- and long-term crop evapotranspiration (ETc), crop coefficients (Kc), and crop yield response.

**Goal:**
1. Quantify and compare dry bean ETc, Kc, and crop water-use efficiency under surface and sprinkler irrigation management systems; and
2. Demonstrate effective irrigation management strategies that could result in higher yields.

**Expected Impact:** Results could help Wyoming dry bean producers better optimize irrigation water under surface and sprinkler systems, which could boost yields.

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**Keywords:** evapotranspiration, crop coefficient, dry bean

**PARP:** IV:1,2,3
Testing for suitable corn hybrids for the Bighorn Basin

**Investigators:** Gustavo Sbatella and Camby Reynolds

**Issue:** Growing conditions in the Bighorn Basin are very different than the locations where corn hybrids are typically tested for performance. For this reason it is important to evaluate corn hybrid production under local environmental conditions.

**Goal:** Evaluate different corn hybrids in the Bighorn Basin.

**Objectives:** Determine which corn hybrids are best adapted for local growing conditions.

**Expected Impact:** Results from this study should provide local growers with information regarding the performance of different corn hybrids in the Bighorn Basin. The study is performed annually, with results released each fall.

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**Keywords:** corn, hybrids

**PARP:** I:12

Interplanting forage legumes with grain corn for late-season forage production

**Investigators:** Gustavo Sbatella and Camby Reynolds

**Issue:** Growers who plant grain corn in the Bighorn Basin often graze cattle in the planted area after harvest because of a lack of other forages this time of year; however, the corn stalks can lack nutritional value. Because of the latter issue, there is a need to evaluate ways to increase the nutritional value of this late-season forage.

**Goal:** Determine if it is possible to interplant grain corn and forage legumes to maximize grain and forage production.

**Objectives:** Evaluate different corn/soybean planting ratios in an effort to provide maximum corn grain production and late-season forage.

**Expected Impact:** Results from this study should provide local growers information regarding the possibility to interplant grain corn and forage legumes in the Bighorn Basin for grain and late-season forage production. The study got underway in 2016, and we expect to release preliminary findings in 2018.

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**Keywords:** corn, forage legumes, interplanting

**PARP:** I:3,6,9
Testing for suitable soybean maturity groups for the Bighorn Basin

Investigators: Gustavo Sbatella and Camby Reynolds

Issue: Some growers in the Bighorn Basin are considering planting soybean as an alternative for their crop rotation. Currently, however, there is limited information about which is the best maturity group that is adapted to the area’s growing conditions

Goal: Evaluate different soybean maturity groups in the Bighorn Basin.

Objectives: Determine which soybean maturity groups are best adapted for local growing conditions.

Expected Impact: Results from this study should provide local growers with important information about the performance of different soybean maturity groups in the Bighorn Basin (2017 marks the third year of the study).

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Keywords: soybean, maturity group, alternative crop

PARP: I:9, II: 9

Effect of micronutrients on sugarbeet production in Wyoming

Investigators: Vivek Sharma and Camby Reynolds

Issue: Profitable sugarbeet production is based on a number of factors, including root yield, sucrose content, and sucrose recovery efficiency. The availability of adequate amounts of both primary and secondary macronutrients (notably nitrogen, phosphorous, potassium, and sulfur) and micronutrients (notably iron, zinc, and manganese) can affect these factors; however, even when adequate amounts of primary and secondary nutrients are present, a lack of micronutrients in soil can limit sugarbeet growth. In Wyoming, the effect of micronutrients on sugarbeet production has not been adequately addressed.

Goal: Evaluate the effect of micronutrients on sugarbeet production at the Powell Research and Extension Center and the James C. Hageman Sustainable Agriculture Research and Extension Center.

Objectives: Determine how different combinations of micronutrient applications affect sugarbeet root yield, sugar yield, and eco-physiological variables.

Expected Impact: Results could (1) assist Wyoming sugarbeet growers better understand the optimum quantity of various micronutrients and the timing of their applications in sugarbeet production; and (2) provide a better understanding of the economic impact of micronutrient applications as related to overall sugarbeet root and sucrose yield.

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Keywords: micronutrient, sugarbeet, yield

PARP: II:2
**Preplant weed control in sugarbeet**

**Investigators:** Gustavo Sbatella and Andrew Kniss

**Issue:** Herbicide-resistant weeds can be particularly difficult to control in sugarbeet because this crop is sensitive to a variety of active ingredients, limiting the options. Therefore, it is important to evaluate if there are alternatives for weed control before planting in sugarbeet.

**Goal:** Evaluate alternatives for preplant weed control for sugarbeet in Wyoming’s sugarbeet growing areas.

**Objectives:** Assess herbicide efficacy and crop safety of herbicides applied preplant to sugarbeet for weed control.

**Expected Impact:** Results from this study should provide information regarding performance of different herbicides for preplant weed control in sugarbeet in Wyoming. The study got underway in 2017 at the Powell Research and Extension Center, and we expect to release preliminary findings in 2018.

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**Keywords:** sugarbeet, preplant herbicides, weed management

**PARP:** III:1,7

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**2016 MillerCoors variety trial**

**Investigators:** Andi Pierson, Camby Reynolds, and Carrie Eberle

**Issue:** The Wyoming Agricultural Experiment Station (WAES) at Powell conducts barley variety trials as part of an ongoing research effort. Malting barley is grown throughout the western United States and Canada, and breeders, industry, and producers need guidance on variety performance across environments.

**Goal:** Conduct spring barley variety trials in coordination with MillerCoors to evaluate production characteristics.

**Objectives:** Collect data on production characteristics of spring malting barley varieties grown in northern Wyoming for MillerCoors.

**Expected Impact:** Malting barley trials, including the one conducted in 2016, should assist with selection of high performing varieties for MillerCoors production in the Bighorn Basin.

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**Keywords:** malt barley, variety trial, MillerCoors

**PARP:** I:12
Broadleaf weed control in barley

Investigator: Gustavo Sbatella

Issue: Management of herbicide-resistant weeds requires an integrated approach; therefore, the ability to control weeds in all crops included in a rotation is essential.

Goal: Evaluate alternatives for the Bighorn and Wind River basins to control broadleaf weeds such as kochia, common lambsquarters, and pigweeds in barley.

Objectives: Assess herbicide efficacy and crop safety of post-emergent herbicides for broadleaf weed control in barley.

Expected Impact: Results should provide important information regarding performance of potentially new commercially available herbicides when compared to current options for broadleaf weed control in Bighorn and Wind River Basin barley fields. The study got underway in 2017, and we expect to release preliminary findings next year.

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Keywords: barley, broadleaf weeds, weed management

PARP: III:1,7

Weed control in established alfalfa stands

Investigator: Gustavo Sbatella

Issue: Weed control in established alfalfa stands is critical to ensure the long-term productivity (both quality and quantity) of alfalfa hay. Herbicide applications to fields with dormant alfalfa allow the use of active ingredients that otherwise would injure the crop if applied during vegetative growth.

Goal: Evaluate the performance of different weed control options in established alfalfa stands for the Bighorn and Wind River basins.

Objectives: Assess herbicide efficacy and crop safety of herbicides applied to established alfalfa stands for weed control.

Expected Impact: Results from this study should provide important information regarding local performance of different herbicides for weed control in established alfalfa stands. The study got underway in 2017, and we expect to release preliminary findings in 2018.

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Keywords: established alfalfa, weed management, crop productivity

PARP: III:7
Exploring options for post-emergent control of annual grassy weeds in new seedling grass grown for seed

**Investigator:** Gustavo Sbatella

**Issue:** Farmers face the challenge to control annual grassy weeds in grasses grown for seed with post-emergent herbicides, but alternatives are limited. A great number of active ingredients are currently labeled for use in small grains, but the crop tolerance of the different species planted for grass seed production to these active ingredients is mostly unknown.

**Goal:** Explore potential options for controlling annual grassy weeds in grasses grown for seed.

**Objectives:** Evaluate crop safety of different active ingredients for annual grassy weed control on perennial grasses grown for seed.

**Expected Impact:** Results should provide important information regarding the potential options for annual grassy weed control in perennial grasses grown for seed.

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**Keywords:** annual grassy weeds, grass grown for seed, weed management

**PARP:** III:8

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Evaluate goji berry as a potential high-value fruit crop in Wyoming

**Investigators:** Jeremiah Vardiman, Sadanand Dhekney, and Michael Baldwin

**Issue:** Some Wyoming farmers, including local food producers, are looking for alternative crops and markets to keep their operations economically viable, especially during years of poor crop prices. High-value alternative crops, such as fruit crops, provide potential new markets and, subsequently, economic stability. Unfortunately, Wyoming’s short growing season, late spring and early fall freezes, wind, high altitudes, and harsh winters can make fruit production extremely difficult and inconsistent as a reliable cash crop.

**Goal:** Evaluate goji berry, aka matrimony vine (*Lycium barbarum*) as a potential high-value crop for Wyoming and study the feasibility of organic production.

**Objectives:** Evaluate the performance of the cold-hardy (U.S. Department of Agriculture Plant Hardiness Zone 3a) goji berry plant to determine the days required for flowering, fruiting, and yield potential at two locations, Powell and Sheridan.

**Expected Impact:** In early June 2016, 50 plants were planted at the Powell Research and Extension Center and 47 at the Sheridan center with a 100% establishment rate. These plants grew late into the fall (early November) even amidst freezes, with some of the plants flowering and producing some fruit. The fruit production was late in the fall, and the yield was not significant enough to measure; however, preliminary results indicate that the plants are well established at both locations. This is very encouraging because other fruit crops such as grapes, raspberries, and strawberries do not typically grow this late in the season and do not produce fruit without season extension protection, such as high tunnels or greenhouses. This research will continue thru 2018.

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**Keywords:** goji berry, fruit, cold-hardy

**PARP:** I:1, X:1