



**Figure 1.** Beans grown under a Solexx roof in 2013.

## Growing Beans at High Elevations Using Season Extension Covers

### Introduction

Often growers in higher elevations are told that growing warm season crops like beans will be low yielding. The CSU Extension office in San Miguel Basin wanted to test this advice and see if there was a way to get stronger yields using season extension practices. Season extension is the practice of extending the frost-free growing season length to add to the time and create better growing conditions a crop needs to produce good quality yield. Locations at high elevations, such as Telluride, CO (8,750 ft.), experience shorter growing seasons and cooler nighttime temperatures, so they could benefit from these season extension practices. To test different methods of extension we grew different green, one gold and purple varieties of bush beans including 'Provider', 'Jade', 'Maxi', 'Purple Queen', 'Dove', 'Purple Burgundy', 'Yellow Wax', 'Contender', 'Strike', and 'Tonya's Pink Pod' under different covers in 2011, 2013, 2017, and 2022 (Figure 1). The covers included a control, 17% row cover material, a Solexx hard cover, Diobetalon, and a double layer of Diobetalon and 30% row cover material. The San Miguel Basin CSU Extension office has provided literature of the advantages and disadvantage of these different season extension covers which can be found [here](#) or on their website. The average ounces of beans per plant was calculated for each of the varieties and each of these treatments.

### How We Grew High Elevation Beans

In areas where temps drop below freezing and soils freeze, growing in a raised bed can help you keep plants alive longer. The benefits of these raised beds can also be increased by utilizing a season-extension cover over the crop like fabrics, hard plastics, or plastic sheeting. In our study we chose materials for our covers for the best light permeability and aeration for the crops.

Our raised beds were filled with [native soil](#) and amended with compost and/or peat moss. We also used straw as a ground cover or mulch because this helps with weeding and insulating the temperature of the soil. By growing in raised beds with the combination of a row cover you can also see benefits in pest

**Key Words:** Diobetalon, Solexx, Row Cover Fabric, Contender, Provider, Strike, Tonya's Pink Pod, Downy Mildew



prevention whether it is disease, insects, or some of the larger pests seen in higher elevations such as rabbits and deer.

### **Our Planting Dates**

It is important at higher elevations to plant warm season plants once the ground is no longer frozen and the danger of frost has passed. We started our beans from seed by directing seeding them into our raised beds in mid to late June each year. Plants were spaced 3 inches from each other with 16 inches between rows with three rows per variety. Germination cloth was kept on tops of the seedlings until they had a second set of true leaves to retain moisture and help them establish. Once the cloth was removed, we thinned out the bean seedling so that they were 4 to 5 inches apart.

### **How We Fertilized**

Our trials were focused on organic production, so we chose to use organic sources of fertilizer for our green beans. We fertilized our plants in 2013 with cotton seed meal and our 2017 and 2022 plants with blood meal. These fertilizers were applied three times during the growing cycle with the first one taking place at planting. They are dry fertilizer sources, so we placed it in the root zone of the plants making sure to follow the application rates recommended on the package for best success. Nitrogen demands were highest during flowering right before the production of the beans. By applying fertilizer throughout the growing cycle, we were able to make sure nitrogen was available for our plants throughout the season.



**Figure 2.** Bean harvest in the 2017 season.

### **How We Harvested**

We began harvesting beans in late August for our 2013 and 2022 seasons and in early September for our 2017 season, and mid-August for the 2011 season. Our beans were harvested by holding the petiole or stem of the bean so that they popped off the plant nicely without breaking the plant (Figure 2). We visited our plots two or three times a week to make sure to harvest from our plants before the seeds were swelling within the pods because this can change the flavor profile.

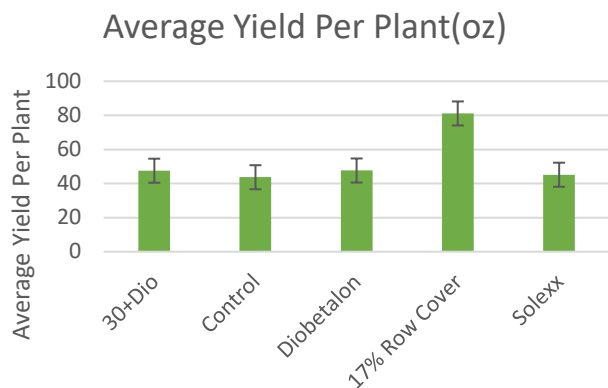
### **Pro Tips/Observations**

- Bean mosaic virus was present with some mottling in some of our beans, but the beans were still edible.
- Downy mildew can become a problem in covered beds, so it is important to have larger spacing between plants for better airflow.



### Differences in Season Extension Covers

The control in our study was a raised bed without a crop cover and the four other covers that we tried were a rigid Solexx cover, a fabric cover called Diobetalon, a fabric 17% row cover, and a double layer of 30% row cover and Diobetalon. The fabric covers were applied on a hoop structure placed on top of the raised bed edges. The control also had a hoop structure with plastic chicken wire over the top for protection from pests like deer and rabbits. Our Solexx treatment was on a hoop structure in 2011 and 2013 and in 2017 and 2022 had a rigid structure closer to a cold frame with a top panel that allowed access to the plants inside.



**Figure 3.** Average bean weight per plant of our treatments.

Varieties did have differences between each other, but not enough difference between the many grown over the three seasons so we will just report on the treatments with the varieties combined. In the 2011 and 2013 seasons, our control plants did not produce due to a lack of protection from a hard freeze. These years the plants were not thinned as much so air flow was lower between plants and downy mildew was a problem. This is why we chose to thin our plants more in future seasons. The 17% row cover treatment was the top performer in the 2017 and 2022 seasons with Solexx as the second-best

treatment. 2022 was the only year we used Diobetalon and our lowest yielding year, so despite how it appears on Figure 3, Diobetalon by itself produced more bean weight per plant than the control in that year. The control performed the worst every season which showed that a cover when growing beans is necessary. If we were to recommend season extension cover for beans, we would suggest either 17% row cover or Solexx (Figure 3). The Solexx treatment has more structure which can protect against the elements but has lower air permeability so larger spacing between plants will be important. The 17% row cover will have better light penetration and air permeability so this cover works well but will have less structural support.

### Acknowledgements

**Authors:** Makenzie Lee, Yvette Henson, Mark Uchanski

**Plant Management and Data Collection:** Randy Stephens, Doris Glynn, Bronwen Spielman, Sarah Zugalla, Nancy Richards

**Funding:** Beds were funded by the CSU Innovation Grant and management was funded by the San Miguel County Extension Office.