# 2023 No-Tillage and Dry Bean Variety Performance

Dr. Heather Darby, UVM Extension Agronomist
Ivy Krezinski
UVM Extension Crops and Soils Technician
802-524-6501

Visit us on the web: http://www.uvm.edu/nwcrops

**2023 No-Tillage and Dry Bean Variety Performance**

Dr. Heather Darby, University of Vermont Extension
heather.darby[at]uvm.edu

Dry beans (*Phaseolus vulgaris*), a high-protein pulse crop, have been grown in the Northeast since the 1800's. As the local food movement continues to diversify and expand, consumers are asking stores to carry more locally-produced foods, and dry beans are no exception. Currently, the demand for locally sourced dry beans has far exceeded the supply. Farmers are also looking for high-value crops to diversify their rotations. Modern breeding efforts have expanded the market classes that can be direct harvested, lowering the barrier to entry by reducing the need for specialized equipment. These alternative market classes are valued by consumers for their culinary characteristics and visual appeal. Current management practices for organic dry beans can deplete the soil because of the reliance on tillage and cultivation for weed management and harvesting. Direct-harvested dry beans, specifically black beans, have shown promise in organic no-till systems and could reduce the negative impacts on soil health while still suppressing weeds. However, there has been little research on how other market classes perform in a no-till production system. To support and expand organic dry bean production throughout the northeast, the University of Vermont Extension Northwest Crops and Soils Program initiated a research trial to evaluate the performance of four dry bean market classes (black, navy, pinto, and small red) in an organic tilled system compared to an organic no-till system.

## MATERIALS AND METHODS

The trial was conducted at Borderview Research Farm in Alburgh, VT during the 2022-2023 season. The experimental design was a randomized complete block wi0 g0 G[( )] TJETQ0.00000912 0 612 792 reW* nBT/F1 11.04 T

treated with dry bean bacterial inoculant (*Rhizobium leguminosarum biovar phaseoli*). The plot size was 10ft x 20ft, with 4 rows at 30-inch spacing.

**Table 2. Trial management information for the dry bean variety x tillage trial, Alburgh, VT, 2022-2023.**

| **Location** | Borderview Research Farm, Alburgh, VT | |
|---|---|---|
| Soil type | Benson rocky silt loam, over shaly limestone, 8 to 15 % slopes | |
| Previous crop | Spring grains | |
| Plot size (feet) | 10 x 20 | |
| Row spacing (inches) | 30 | |
| Replicates | 4 | |
| Seeding rates (pure live seeds $ac^{-1}$) | Black, navy, & small red: 125,000<br>Pinto: 95,000 | |
| Tillage operations | <u>Tillage</u> | <u>No-till</u> |
| | Moldboard plow | Cereal rye (var ND Gardner) |
| | Pottinger TerraDisc® | Planting date: 17-Sep 2022 |
| | 28-Apr 2023 | Seed rate: 3 million live seeds $ac^{-1}$ |
| | | Roll/crimp 31-May 2023 |

Data were analyzed using a general linear model procedure of SAS (SAS Institute, 1999). Replications were treated as random effects, and treatments were treated as fixed. Mean comparisons were made using the Least Significant Difference (LSD) procedure where the F-test was considered significant, at $p<0.10$.

Variations in yield and quality can occur because of variations in genetics, soil, weather, and other growing conditions. Statistical analysis makes it possible to determine whether a difference among treatments is real or whether it might have occurred due to other variations in the field. At the bottom of each table an LSD value is presented for each variable (i.e. yield). Least Significant Differences (LSDs) at the 0.10 level of significance are shown. Where the difference between two treatments within a column is equal to or greater than the LSD value at the bottom of the column, you can be sure that for 9 out of 10 times, there is a real difference between the two treatments. In this example, treatment C is

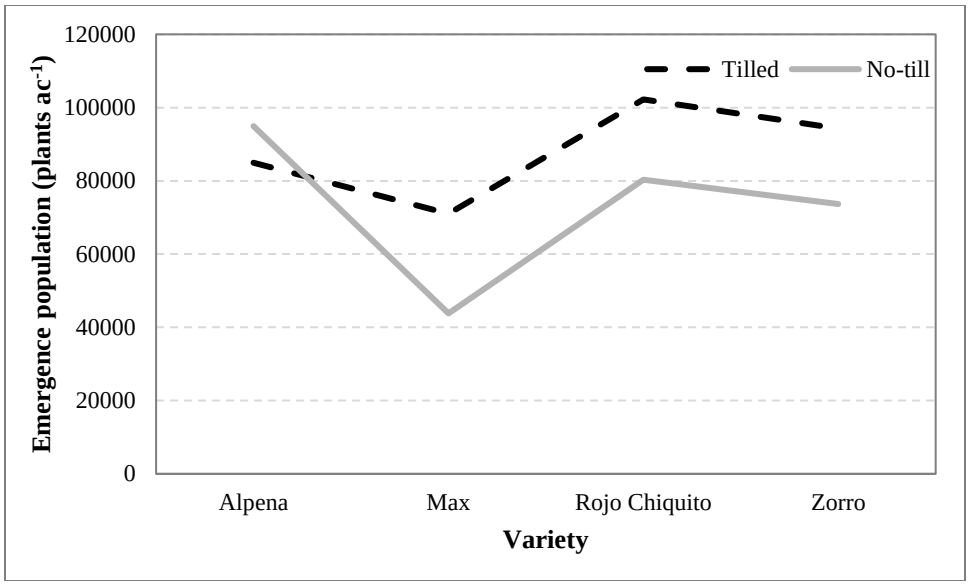


**Figure 1. Emergence population by variety in tilled treatment compared to no-till treatment, Alburgh, VT, 2023.**

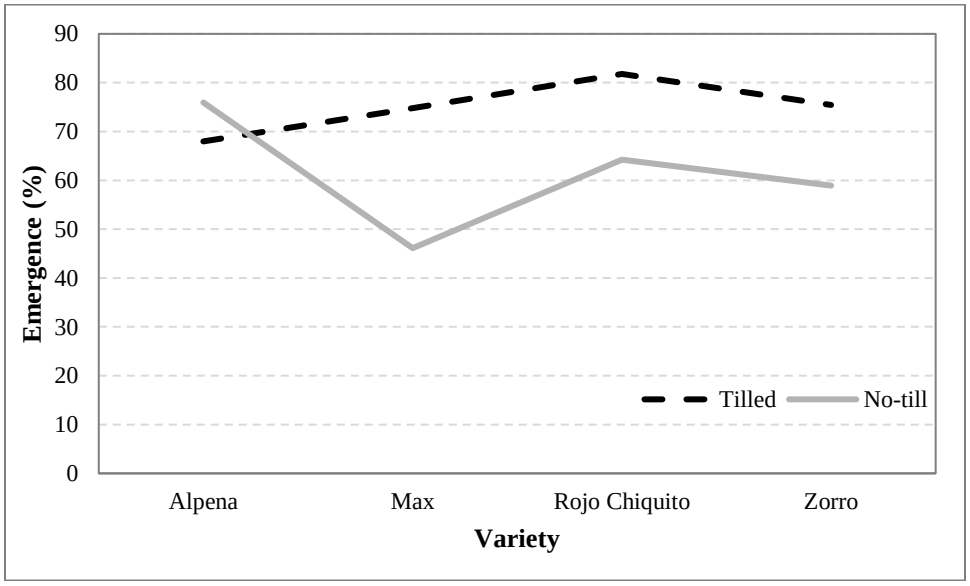


**Figure 2. Percent emergence by variety in tilled treatment compared to no-till treatment, Alburgh, VT, 2023.**

**Figure 3. Unmarketable seed by variety in tilled treatment compared to no-till treatment, Alburgh, VT, 2023.**

**Figure 4. Adjusted seed yield by variety in tilled treatment compared to no-till treatment, Alburgh, VT, 2023.**

***Impact of dry bean variety***

or weed biomass between varieties. Similar to flowering date, Max reached maturity on 6-Sep, which was a week earlier than the next variety to reach maturity, Alpena. Rojo Chiquito and Zorro reached maturity 17 and 18 Sep and were not statistically different.

**Table 6. Harvest characteristics by dry bean variety, Alburgh, VT, 2023.**

| Variety | Market class | Lodging | Pod height | Harvest moisture | Test weight | Yield at 14% moisture | Unmarketable seed | Adjusted yield at 14% moisture | 100-seed weight |
|---|---|---|---|---|---|---|---|---|---|
| | | 1-5 rating† | cm | % | lbs $bu^{-1}$ | lbs $ac^{-1}$ | % | lbs $ac^{-1}$ | grams |
| Alpena | Navy | 1.38[c]‡ | 6.67[b] | 18.0[a] | 53.3[a] | 2900[a] | 11.3[a] | 2591[a] | 19.9[d] |
| Max | Pinto | **5.00[a]** | 3.23[c] | **17.5[a]** | 47.9[b] | 2358[b] | 42.6[b] | 1459[b] | **46.3[a]** |
| Rojo Chiquito | Small red | 2.38[b] | **10.2[a]** | 20.0[b] | **54.2[a]** | 2754[a] | 10.5[a] | 2468[a] | 25.5[b] |
| Zorro | Black | 2.50[b] | 9.24[a] | 18.1[a] | 53.8[a] | **2963[a]** | **8.13[a]** | **2730[a]** | 24.4[c] |
| LSD (p = 0.10)§ | N/A¥ | 0.48 | 1.86 | 1.25 | 1.72 | 363.8 | 6.37 | 378 | 0.74 |
| Trial Mean | | 2.81 | 7.34 | 18.4 | 52.4 | 2744 | 18.1 | 2312 | 29 |

†Lodging scale: 1=all plants erect; 5=all plants horizontal.

‡Within a column, treatments markef*52/F1D.q480.7 539.47 47.28 16.584 reW* n7T6.584 re* n7T6.58e,

in the tilled plots. Tillage treatment had no significant impact on test weight, and the trial average was 52.4 lbs $bu^{-1}$. Seed yield was significantly higher in the tilled plots (3098 lbs $ac^{-1}$) than in the no-till plots (2390 lbs $ac^{-1}$). There was 13.8% unmarketable seed in the tilled plots, and this was significantly lower than in the no-till plots, which had 22.4% unmarketable seed. Adjusted seed yield was significantly lower in the no-till plots (1941 lbs $ac^{-1}$) compared to the tilled plots (2683 lbs $ac^{-1}$). There were no significant differences in 100-seed weight between the treatments.

**Table 8. Harvest characteristics by tillage treatment, Alburgh, VT, 2023.**

| Treatment | Lodging | Pod height | Harvest moisture | Test weight | Yield at 14% moisture | Unmarketable seed | Adjusted yield at 14% moisture | 100-seed weight |
|---|---|---|---|---|---|---|---|---|
| | 1-5 rating† | cm | % | lbs $bu^{-1}$ | lbs $ac^{-1}$ | % | lbs $ac^{-1}$ | grams |
| Tillage | 2.75 | 6.27[b]‡ | 19.2[b] | 52.0 | **3098[a]** | **13.8[a]** | **2683[a]** | 29.2 |
| No-Till | 2.88 | **8.41[a]** | **17.6[a]** | 52.9 | 2390[b] | 22.4[b] | 1941[b] | 28.9 |
| LSD (p = 0.10) § | NS¥ | 1.32 | 0.89 | NS | 257.3 | 4.51 | 267.3 | NS |
| Trial Mean | 2.81 | 7.34 | 18.4 | 52.4 | 2744 | 18.1 | 2312 | 29.0 |

†Lodging scale: 1=all plants erect; 5=all plants horizontal.
‡Within a column, treatments marked with the same letter were statistically similar (p=0.10).
§LSD –Least significant difference at p=0.10.
¥NS-No Significant difference between treatments.

# DISCUSSION

Dry bean varieties from four different market classes (navy, pinto, small red, and black) were grown in a

loss of almost 1500 lbs $ac^{-1}$ for Max in the no-till system. While overall yields were good for the other three varieties, Rojo Chiquito had almost no difference in seed yield between the tillage treatments, suggesting that this variety may be well suited for a no-till cropping system. Results from a black bean seeding rate study conducted at Borderview Research Farm this season suggest that the black bean variety Zorro can also produce statistically similar yields in a no-till system when planted at 120,000 seeds $ac^{-1}$. The variety