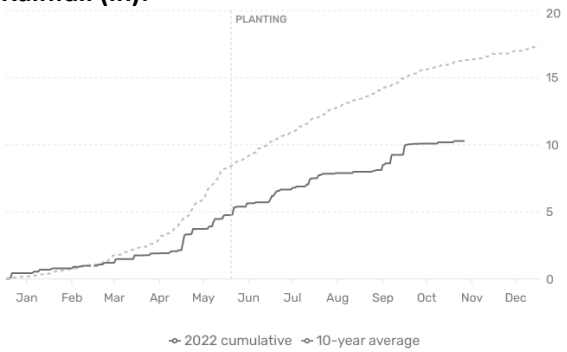
Evaluating Nitrogen Rates and Strip-till for Pinto Beans

Study ID: 1401007202201
County: Banner
Soil Type: Altvan-Eckley complex 3-9% slopes; Satanta fine sandy loam 1-3% slope; Satanta-Altvan complex 3-6% slopes; Duroc loam 1-3% slope
Planting Date: 6/2-3/22
Harvest Date: 9/27-28/22
Seeding Rate: 90,000
Row Spacing (in): 30
Hybrid: Radiant slow-darkening pinto
Reps: 4
Previous Crop: Corn
Tillage: Strip-till, no-till
Herbicides: ***Pre:*** 15 oz/ac Prowl® H2O, 7 oz/ac Outlook®, 1 oz/ac Vida®, and 15 oz/ac Envy™ Six Max with ammonium sulfate and crop oil concentrate on 6/4/22 ***Post:*** 3 oz/ac Outlook®, 7 oz/ac PHT® Persist® Ultra, 3.14 oz/ac Assure® II, 9.41 oz/ac Varisto®, and 3.14 oz/ac Basagran® 5L
Desiccation: Gramoxone® 9/19/22
Seed Treatment: Apron® XL, Maxim®, Rancona®, Vibrance®
Foliar Insecticides: None
Foliar Fungicides: 0.78 oz/ac Priaxor® Xemium® on 6/28/22
Fertilizer: 20 lb N/ac applied via fertigation; other fertilizer varied by rates being tested in the study
Irrigation: Pivot, Total: 10"
Rainfall (in):



Baseline Soil Samples, 0-8" (May 2022):

		OM	Melich-III	Nitrate – N	Sulfate-S	-------Melich III-------				CEC
	pH	LOI %	P ppm	ppm N	ppm S	K	Ca	Mg	Na	me/100g
NE-1	6.8	2.0	34	6.3	8.0	285	1191	221	16	8.6
NE-2	6.9	2.2	42	13.4	14.6	315	1315	202	16	9.1

Introduction: Pinto bean growers have questions about the optimal level of nitrogen (N) fertilizer. Historically, most producers have used N fertilizer in their pinto bean production, but recent data has shown less N may be needed to achieve competitive and profitable yields.

The goal of this study was to evaluate the impact of three nitrogen rates applied with strip-till on pinto bean production. Additionally, the producer was interested in the impact of the strip-till operation, so a fourth treatment was added to evaluate no-till.

The fertilizer applied with strip-till was a liquid blend of 32-0-0, 10-34-0, and 9-0-0-26. A sample of the fertilizer blend was sent to Ward Laboratories, and analysis showed a composition of 28% N, 4% P_2O_5, and 1% S. The fertilizer was evaluated at rates of 0 gal/ac, 12 gal/ac (grower's normal management), and 24 gal/ac. The 12 gal/ac treatment received 36 lb N/ac, 2.3 lb P/ac, and 1.3 lb S/ac, whereas the 24 gal/ac treatment received 72 lb N/ac, 4.6 lb P/ac, and 2.6 lb S/ac. Additionally, the entire field received 20 lb N/ac through the pivot.

A rye cover crop was broadcast planted at 100 lb/ac on October 10, 2021, and the strip-till application occurred in the green cover crop on May 19 on one field and May 28 on the other field. The fields were planted on June 2 and 3, 2022, and the cover crop was terminated on June 5, 2022. The cover crop was 12-24" tall at the time of termination.

Data Collection: Satellite imagery was obtained through Skysat, a high-resolution constellation of 21 satellites operated by Planet®, and the normalized difference vegetation index (NDVI) was evaluated for each treatment. Early season stand counts were taken on July 6, 2022. Samples from each plot were analyzed for bean quality parameters. Pod height measurements were taken to determine the percent of pods 2" or greater above the soil surface. Harvest loss estimates were determined by taking counts in one-square-foot frames randomly chosen in the harvested area, but equally representing the left side of header, center of header, and right side of header area behind the combine. Yield was obtained using the combine yield monitor, and was post-processed to remove erroneous data points.

Results:

	Early Season Stand Count (plants/ac)	Pods > 2" Above Ground (%)	Harvest Loss (bu/ac)	Moisture (%)	Yield (bu/ac)†	Marginal Net Return‡ ($/ac)
0 gal/ac, no-till	45,020 B*	68 A	0.9 A	10.9 A	21 B	468 BC
0 gal/ac	54,982 A	69 A	1.6 A	9.9 A	24 A	534 A
12 gal/ac	48,558 AB	66 A	1.2 A	10.2 A	25 A	498 AB
24 gal/ac	48,123 AB	66 A	1.6 A	10.4 A	24 A	434 C
P-Value	0.040	0.139	0.091	0.145	0.003	0.005

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 14% moisture.
‡Marginal net return based on $38/cwt ($22.80/bu) pinto beans, $3.85/gal of fertilizer, $19/ac for strip-till with no fertilizer application (from 2022 UNL custom rates), and $25/ac for strip-till with fertilizer application (from 2022 UNL custom rates).

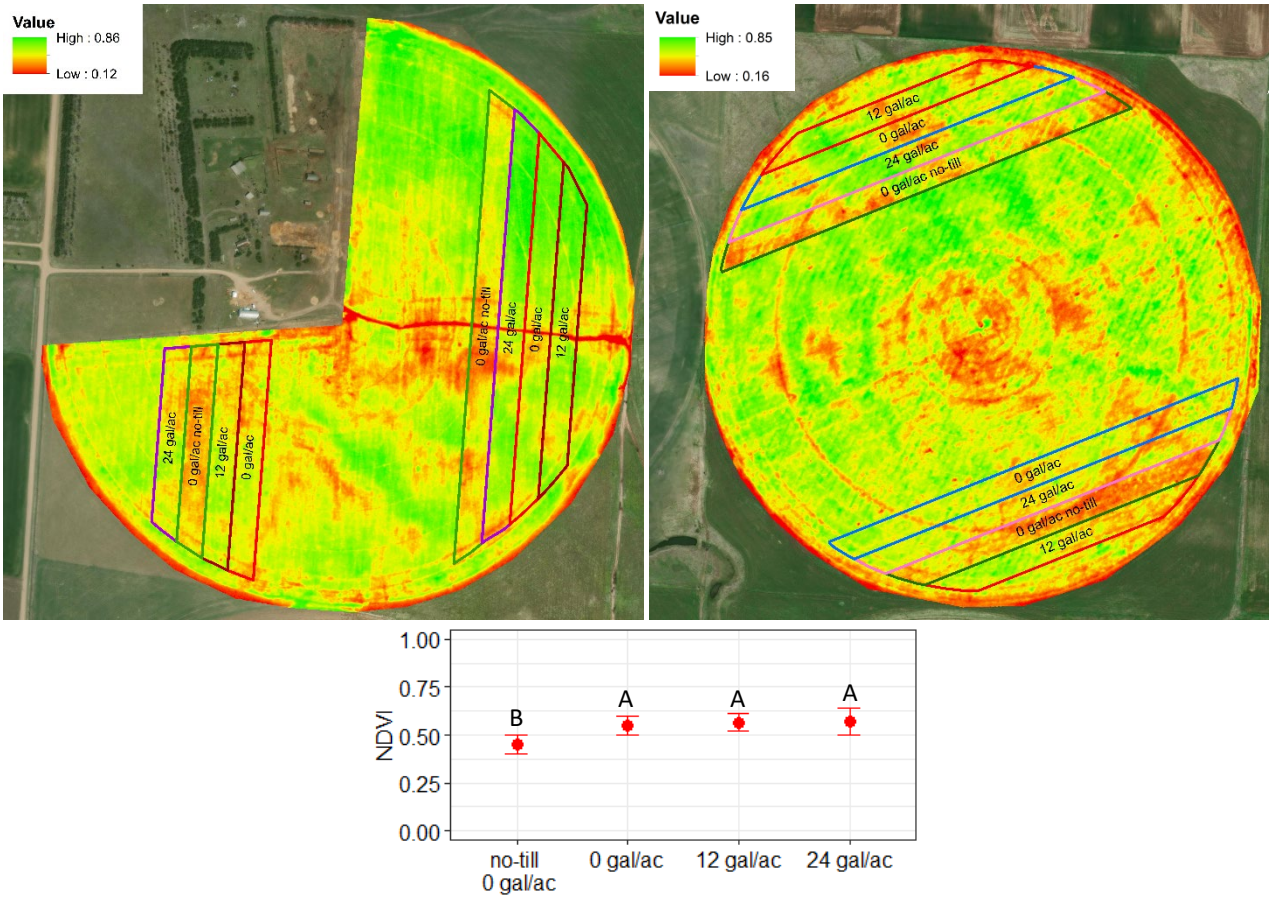


Figure 1. Normalized difference vegetation index (NDVI) from August 8, 2022. Top: treatments are outlined and labeled overlaid on NDVI image. Bottom: NDVI mean and standard deviation are shown for each treatment. Values with the same letter are not significantly different at a 90% confidence level.

Summary:

- Early season stand counts showed the 0 gal/ac no-till treatment had significantly lower stand than the 0 gal/ac strip-till treatment. Populations were lower than desired due to deep planting depth (2.5 inches) and heavy residue, especially in the no-till treatment.
- Satellite imagery obtained on August 9 showed differences in the NDVI. The no-till treatment had lower NDVI values than the strip-till treatments, and was visually apparent in the imagery. NDVI values were similar for the three strip-till treatments (Fig. 1).
- The no-till treatment had 3-4 bu/ac lower yield compared to the strip-till treatments. There were no yield differences among the different fertilizer rates applied with strip-till. This resulted in the greatest net return for the 0 gal/ac strip-till treatment. Heavy weed pressure in replications one and two negatively impacted yield.