

## Summary of NP Genotype Study at Powell – 2020

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### *Introduction and Methods*

This study is part of a broader project where we are trying to identify or develop superior varieties for Wyoming that use less fertilizer. Thus, we are testing popular varieties along with experimental lines that we developed. Our PREC breeding program has been funded separately by Wyo Dept Agric but that project and this particular Wyo Bean Commission project have shared objectives.

The study was designed using randomized complete split plots with N/P fertility as the main plot and cultivar as the subplot at the Powell REC in 2020. In May, twelve 11-foot wide strips were established in the field and N rate and P rate were varied. N was applied at either 0 or 50 pounds of N per acre as urea and P<sub>2</sub>O<sub>5</sub> was applied at either 0, 67, or 135 pounds per acre as triple superphosphate. There were two randomly-located strips for each unique combination of N-P fertilizer. Early and late-maturing cultivars were sown on 27/28 May (one block each day) in six-row plots using 22-inch row spacing (11-foot-wide plots). Flowering, maturity, NDVI/NDRE (normalized difference vegetation index), height, upright stature were recorded throughout the season. NDVI provides a gauge on canopy greenness and health (higher values are healthier). Leaf blade samples collected on 22 July 2020 and soil samples were collected on 31 July 2020. Yield and seed size were determined at maturity.

### *Results*

Yields were down somewhat compared to previous years due to the hot summer (Table 1). Some of our UW experimental lines competed successfully with several of the commercial checks. In the previous year's study, La Paz outyielded all other lines but that was not the case this year. The experimental line PT9-5-6 (a pinto line bred in Prosser, WA) ranked high in yield along with LPID-3. One of the problems with LPID-3 is its poor upright rating. We are uncertain whether or not this a fatal trait. Poncho is a successful variety and it has a poor upright rating (very prostrate). LPID-3 appears to be relatively early maturity and that would be a good trait for Wyoming (in most years). The good performance of PT9-5-6 is not a new observation here in the Bighorn Basin and we hope to include PT9-5-6 in future tests going forward.

Tables and Summary are continued on pages 2 and 3.

Table 1. Yield, seed size, flowering date, maturity date, upright stature (0=prostrate; 10=fully upright), and height of three LPID lines developed by this project as compared to one of the parental lines (Long's Peak), two public lines, and five commercial check cultivar of the screening trial grown in Powell during 2020. All entries were subjected to two levels of N fertilizer (0 and 50 lbs per acre) and three levels of P fertilizer (0, 67, and 135 pounds of P<sub>2</sub>O<sub>5</sub> per acre). Values are the average of 12 distinct plots. The effect of fertilizer treatment was detected only for seed size (please see Tables 2 & 3).

Entry	Yield	Seed Size	Flower Date	Maturity Date	Upright Stature	Height
	lbs per acre	mg	dap	dap		cm
La Paz	2532	317	55	90	9	76
Long's Peak	2336	328	54	89	9	68
LPID-3	2889	385	47	85	6	67
LPID-7	2401	229	49	85	7	71
LPID-9	2766	372	50	92	5	85
Poncho	2580	351	46	81	3	82
PT11-13-1	2338	332	53	90	9	66
PT9-5-6	2772	311	52	92	8	72
Sundance	2446	331	48	88	8	67
Windbreaker	2764	363	52	91	6	63
LSD (0.05)	271	15	2	3	1	6

As for the effects of the N and P fertilizer rates on yield, none were found (Table 2). However, the fertilizer rates affected seed size and there was an N Rate-by-P Rate interaction (Table 3). That interaction was caused by the slightly higher seed size for the 50 pound N and 67 pound P<sub>2</sub>O<sub>5</sub> rate but this interaction does not appear to be agronomically meaningful.

Because deficiency in N and P can be detected through reflectance measurements, we routinely measured NDVI and NDRE throughout the season. Although no differences in NDVI and NDRE were detected between fertilization treatments, cultivars such as Sundance showed lower NDVI and NDRE throughout the season (Table 4). Leaf chlorophyll concentration was also lower in Sundance. This low chlorophyll and low NDVI/NDRE response by Sundance has been consistent across years.

Table 2. Effect of two fertilizer-N rates and three fertilizer-P on yield of dry bean of the ten-entry trial grown in Powell during 2020. Source of N was urea. Source of P was triple super phosphate. Values are averaged across 10 entries. No differences were found.

Fertilizer N Rate (lb N/a)	Fertilizer P Rate (lb P <sub>2</sub> O <sub>5</sub> /a)		
	0	67	135
	----- Yield (lbs/a) -----		
0	2509	2441	2558
50	2671	2654	2528

Table 3. Effect of two fertilizer-N rates and three fertilizer-P on seed size of dry bean from the ten-entry trial grown in Powell during 2020. Source of N was urea. Source of P was triple super phosphate. Values are averaged across 10 entries. P-values for the main effects were: N Rate = 0.006; P Rate = 0.022; N Rate-by-P rate = 0.003.

Fertilizer N Rate (lb N/a)	Fertilizer P Rate (lb P <sub>2</sub> O <sub>5</sub> /a)		
	0	67	135
	----- Seed Size (mg) -----		
0	333	332	338
50	335	351	336

Table 4. Effect of cultivar on NDVI, NDRE, and leaf chlorophyll values (SPAD) for the test in Powell during 2020. Values are averaged across N and P fertilizer levels which had no effect on any of the sampling dates. N=12 (each value is the average of 12 plots).

Entry	NDVI 23 June	NDRE 23 June	NDVI 2 July	NDVI 2 July	NDVI 13 July	NDVI 13 July	SPAD 16 July
La Paz	0.33	0.13	0.54	0.21	0.63	0.22	47
Long's Peak	0.30	0.12	0.51	0.20	0.64	0.22	45
LPID-3	0.36	0.14	0.56	0.21	0.68	0.23	43
LPID-7	0.35	0.14	0.54	0.20	0.67	0.23	44
LPID-9	0.35	0.14	0.55	0.22	0.65	0.24	47
Poncho	0.35	0.15	0.57	0.22	0.72	0.25	48
PT11-13-1	0.33	0.13	0.53	0.20	0.62	0.22	42
PT9-5-6	0.34	0.13	0.55	0.21	0.66	0.23	44
Sundance	0.29	0.12	0.49	0.19	0.61	0.19	42
Windbreaker	0.32	0.13	0.52	0.21	0.65	0.23	48
LSD (0.05)	0.02	0.01	0.03	0.01	0.04	0.01	3

### Summary

The past two years of this research has two take-home lessons. First, the response to N and P fertilizer have been inconspicuous at least statistically. There has been no penalty from adding N fertilizer so as long as N is cheap, growers can probably apply as an insurance. The second take-home lesson is that all of varieties that we have tested so far appear to respond similarly to fertilizer N and P. Thus, we have no evidence for recommending that different varieties be grown on soil low in N and P.