2021 RESEARCH REPORT

SAGINAW VALLEY

RESEARCH & EXTENSION CENTER

MICHIGAN STATE UNIVERSITY

AgBioRESEARCH

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SAGINAW VALLEY RESEARCH AND EXTENSION CENTER REPORT

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INTRODUCTION

The Michigan sugar beet grower cooperative, Michigan Sugar Company, and the Michigan dry bean growers and industry represented by the Michigan Bean Commission and Michigan Bean Shippers Association, donated the proceeds of the 120 acre Saginaw Valley Bean and Beet Research Farm, located in Saginaw County for 38 years, to Michigan State University in 2009. The Michigan Wheat Program and Michigan Corn Marketing Program also are contributing partners. The Michigan State University Office of AgBioResearch operates a 450 acre farm near Richville Michigan in Denmark Township and is established as an AgBioResearch research center. The Education Center was completed in 2016. In 2020, due to the Covid-19 pandemic the Education Center was shut down. In 2021, the Education Center hosted limited meetings including the annual SVREC field day. The site is located on the southeast corner of Reese and Krueger Roads, address of 3775 South Reese Road, Frankenmuth, Michigan 48734.

Field research at the SVREC was initiated in 2009 and the 2021 season was the 13th season of research at this location. This year research was conducted on 137 of the 450 acres of the center, with 40 acres of dry bean, 35 acres of wheat, 2 acres of pickle, 50 acres of sugarbeet, and 10 acres of soybean research. This research report is primarily a compilation of research conducted at the center in 2021. Most of the work represents one year's results, and even though multi-season results are included, **this work should be considered as a progress report.**

Soil – The soil type on the farm is classified as a Tappan-Londo loam, these are very similar soil types separated by subsoil drainage classifications, the Tappan not being as naturally well drained as the Londo. The site was soil tested in spring 2009 at 2.5 acre increments. The soil pH averages 7.9, soil test phosphorus averages 56 pounds of P per acre, soil test potassium averages are 294 pounds of K per acre.

Weather – The monthly rainfall for 2021 is collected with the automated rain gauge and is presented in Table 1. The monthly totals are given at the bottom of the table. Rainfall was near average the whole year, the first half of the year was dry and above average amounts were received during the growing season. Monthly precipitation over the last 30 years can be found in Table 2. Maximum and minimum daily temperatures are given in Table 3. The 2021 season was warm during the three summer months of June, July, and August with 7 days above 90° F and 39 days above 85° F. The growing degree days for 2021 was 2,963, which was the highest value recorded in the last 50 years (Table 4). The added degree days plus the above average rainfall during the growing season was also a first resulting higher than normal crop yields. This year, average yields for crops grown at the center were: corn 210 bushels/acre, soybean 80 bushels/acre, wheat 90 bushels/acre, dry bean 45 cwt/acre, and sugarbeet 50 tons/acre.

Table 1.

PRECIPITATION - SAGINAW VALLEY RESEARCH & EXTENSION CENTER- 2021

Day:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1								0.47				
2	0.24				0.11							
3	0.01				0.05					0.42		
4					0.17				0.01	0.7		
5		0.07		0.21								0.11
6							0.23					0.05
7					0.22		0.01		1.48	0.28		
8				0.09	0.06	0.14	0.58	0.23	0.01	0.05		
9				0.07						0.01		
10				0.22		0.14		0.23		0.15		0.20
11			0.06			0.51		0.14			0.09	0.35
12		0.01		0.03		0.14		0.13	0.55	0.07		
13						0.01	0.12		0.28			
14						0.22			0.18	0.38	0.11	
15	0.10			0.04			0.02			0.11		0.16
16			0.01							0.09		
17		0.09									0.55	
18	0.07		0.01			0.09					0.01	0.06
19		0.02		0.04		0.01						0.03
20						0.13			0.11			0.01
21						0.16			0.16	0.31	0.01	
22		0.05			0.03	0.17			1.07		0.01	
23		0.04			0.04				0.92	0.02		
24			0.09		0.01	0.06	1.51	0.17	0.02	0.04		0.03
25			0.05			1.12		0.01	0.26	0.58	0.15	0.13
26	0.01		0.94		0.14	1.37				0.07		
27		0.11	0.02			0.14		1.35		0.01		0.17
28			0.11		0.33	0.02		0.34			0.13	
29				0.01		0.03	0.09	0.01		0.39		0.07
30	0.01					0.47				0.08	0.06	0.03
31			0.01				0.33					0.03
TOTAL	**0.44**	**0.39**	**1.30**	**0.71**	**1.16**	**4.93**	**2.89**	**3.08**	**5.05**	**3.76**	**1.12**	**1.43**

Rainfall is measured in inches.

2021 YEAR END TOTAL – 29.19 INCHES

Table 2.

MONTHLY PRECIPITATION, SAGINAW VALLEY RESEARCH FARM

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1991	0.85	0.60	3.68	6.61	3.71	2.66	4.53	2.61	1.50	3.52	2.04	1.24	**31.58**
1992	1.20	1.65	1.31	4.56	1.10	2.10	4.33	2.92	4.08	2.54	4.50	2.10	**32.39**
1993	2.72	0.47	0.87	4.08	2.76	3.03	2.46	4.62	4.00	3.70	1.99	0.53	**31.23**
1994	0.55	0.66	0.91	3.58	2.04	6.99	2.57	4.44	2.19	2.24	4.40	1.03	**31.60**
1995	1.67	0.35	1.38	2.72	1.44	1.96	1.29	5.00	1.33	2.39	4.05	0.79	**24.37**
1996	0.83	0.94	0.49	3.18	5.47	5.65	2.32	1.53	3.52	3.31	1.37	2.21	**30.82**
1997	1.51	4.25	1.32	1.38	3.00	0.69	2.44	3.61	3.46	1.31	1.03	0.36	**24.36**
1998	2.66	2.05	3.17	2.14	1.87	1.56	1.02	2.01	1.41	3.18	1.79	1.32	**24.18**
1999	2.75	0.41	0.62	5.01	2.33	3.07	5.02	3.01	2.52	1.12	1.04	1.90	**28.80**
2000	0.57	1.35	0.89	2.94	5.34	2.65	3.03	3.69	3.27	0.90	2.07	1.57	**28.27**
2001	0.33	3.16	0.11	2.38	4.42	2.45	0.53	3.52	4.34	4.90	1.76	1.61	**29.51**
2002	1.02	1.49	2.47	3.49	4.46	3.15	3.00	4.50	0.50	1.87	1.19	0.97	**28.11**
2003	0.27	0.21	1.66	0.36	4.19	2.04	2.49	1.33	1.99	1.09	5.35	1.20	**22.18**
2004	1.09	0.55	2.50	1.31	7.34	2.70	2.01	2.32	0.66	2.41	3.44	1.51	**27.84**
2005	2.90	0.71	0.62	1.32	1.74	4.97	3.20	0.72	0.72	1.30	3.83	1.49	**23.52**
2006	1.91	1.57	1.59	1.87	4.17	2.03	5.72	2.61	2.53	3.77	3.05	2.81	**33.63**
2007	1.11	0.35	1.27	3.02	2..20	1.06	2.59	4.80	2.64	2.86	0.89	1.93	**22.52**
2008	1.76	2.59	1.23	1.99	1.13	3.88	3.94	2.10	5.61	1.70	1.36	1.21	**28.50**
***2009**	0.01	2.12	1.84	4.69	1.23	4.81	2.73	3.48	0.82	3.61	0.47	1.88	**27.69**
2010	0.14	0.20	0.40	2.15	3.36	2.71	0.89	1.27	3.11	1.94	1.97	0.42	**18.56**
2011	0.48	0.24	1.82	4.96	3.86	1.51	1.34	2.98	2.28	2.85	2.74	1.42	**26.48**
2012	1.86	0.76	1.41	1.19	3.92	1.10	3.62	4.03	1.60	4.29	0.38	1.41	**25.57**
2013	2.77	0.84	0.36	7.38	3.43	1.73	2.03	1.85	0.58	3.26	2.34	0.74	**27.31**
2014	0.47	0.55	0.92	3.99	3.06	2.74	4.17	3.90	3.03	2.10	2.07	1.49	**28.49**
2015	0.59	0.08	0.56	1.97	2.86	2.68	2.20	3.94	2.62	1.96	1.26	2.04	**22.76**
2016	0.94	0.73	4.09	1.30	1.59	1.51	3.47	5.15	2.03	2.11	2.14	0.81	**25.87**
2017	2.80	1.98	1.90	5.79	1.97	4.83	1.10	2.26	1.54	3.52	2.08	0.33	**30.10**
2018	0.71	1.96	0.54	2.82	2.14	1.47	1.98	7.90	1.92	2.65	1.27	2.17	**27.53**
2019	0.61	0.92	1.33	2.27	5.02	6.97	2.37	1.06	3.78	6.29	1.41	2.03	**34.06**
2020	2.30	0.32	2.07	2.08	3.75	1.35	3.24	3.36	2.75	2.37	1.50	1.84	**26.93**
2021	0.44	0.39	1.30	0.71	1.16	4.93	2.89	3.08	5.05	3.76	1.12	1.43	**26.26**
AVG.	**1.28**	**1.11**	**1.44**	**3.01**	**3.03**	**2.93**	**2.73**	**3.21**	**2.50**	**2.74**	**2.13**	**1.41**	**27.52**

**Station moved from Saginaw, MI to Richville, MI*

Table 3.

MAXIMUM-MINIMUM AIR TEMPERATURES (F)

SAGINAW VALLEY RESEARCH & EXTENSION CENTER - 2021

	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE	
DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	31	12	30	13	37	18	35	21	69	26	77	49
2	36	29	32	13	37	14	47	19	84	52	76	51
3	37	29	35	9	49	30	63	29	62	49	81	54
4	33	29	36	17	32	22	65	30	60	45	89	63
5	33	29	33	14	39	20	58	43	54	39	90	71
6	35	31	19	10	38	22	78	43	50	33	91	69
7	35	21	15	-1	36	15	81	48	54	33	84	71
8	29	18	17	-1	60	27	79	54	55	35	83	69
9	36	18	18	-1	56	26	72	53	54	36	89	65
10	30	17	18	-1	68	39	74	44	55	32	87	62
11	30	25	19	-1	64	38	61	47	54	32	90	63
12	30	25	19	4	50	26	60	47	65	33	84	58
13	39	30	19	-6	50	18	62	39	69	34	84	63
14	42	30	18	-6	42	22	52	34	73	40	74	57
15	36	30	13	5	37	16	46	35	73	45	73	53
16	32	26	21	-6	40	27	57	37	68	53	76	48
17	34	26	23	-11	52	27	59	34	78	49	82	69
18	32	26	24	-1	41	29	61	35	81	51	82	64
19	29	18	30	14	46	19	58	38	85	57	77	61
20	26	13	26	9	57	23	40	28	88	65	84	55
21	38	26	32	2	66	27	42	24	88	64	73	45
22	33	16	35	27	70	36	50	20	87	64	65	41
23	27	16	43	31	72	47	65	31	79	51	73	46
24	29	18	43	28	69	49	61	40	78	52	77	63
25	31	22	37	18	54	36	51	33	89	67	72	66
26	30	19	41	20	45	34	51	30	79	54	79	65
27	23	4	42	31	53	35	78	45	59	39	84	70
28	22	16	50	31	51	31	68	45	49	39	87	63
29	27	7			51	24	53	45	62	35	85	70
30	28	1			69	44	55	38	70	35	83	66
31	30	22			55	29			75	49		

Table 3. (cont.)

MAXIMUM-MINIMUM AIR TEMPERATURES (F)

SAGINAW VALLEY RESEARCH & EXTENSION CENTER - 2021 cont.

	JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	75	57	72	53	77	51	77	46	48	34	41	26
2	75	54	77	51	78	48	81	53	46	32	48	32
3	84	53	80	52	73	48	74	64	44	27	37	31
4	89	59	82	57	75	56	65	60	46	26	39	27
5	88	68	84	57	79	57	75	54	51	27	33	25
6	90	68	82	62	74	54	72	51	54	33	37	23
7	73	65	83	63	84	49	68	61	65	37	23	16
8	67	58	85	67	76	58	73	62	64	44	27	17
9	77	57	86	68	72	51	73	58	54	32	36	17
10	76	50	84	70	75	47	75	61	55	27	44	31
11	75	60	87	67	81	58	82	67	64	42	59	31
12	76	57	85	69	70	59	72	63	50	34	46	30
13	80	66	78	59	68	58	73	60	43	34	47	32
14	84	64	78	54	87	61	77	55	37	32	47	25
15	79	63	81	53	77	54	63	52	40	30	58	41
16	74	57	78	53	78	49	58	48	43	27	61	35
17	81	59	82	56	84	55	63	41	59	37	36	28
18	84	55	87	61	76	50	66	38	45	31	33	28
19	85	61	90	61	80	44	73	40	42	29	32	20
20	86	63	89	60	79	60	71	49	38	31	37	26
21	76	52	88	62	75	56	66	44	44	29	36	20
22	76	49	85	65	57	52	49	35	35	21	31	18
23	78	63	85	64	58	48	54	36	36	19	32	17
24	84	65	89	62	72	49	51	32	50	30	47	29
25	86	63	88	68	65	50	48	43	47	29	47	30
26	88	60	91	66	70	46	49	37	30	25	35	24
27	83	65	85	64	80	58	52	43	31	21	35	27
28	87	60	90	69	70	46	60	46	33	24	34	26
29	86	66	89	67	75	44	55	49	35	20	36	27
30	74	55	82	60	76	42	52	47	35	17	33	26
31	77	51	77	55			56	40			36	32

Table 4. **GROWING DEGREE DAYS - SAGINAW VALLEY RESEARCH FARM**

Base 50 (max + min / 2 - 50)

	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	TOTAL
1985	183.50	306.00	388.00	603.50	523.00	394.50	100.00	**2498.50**
1986	124.50	310.00	435.00	664.00	459.50	370.00	96.50	**2459.50**
1987	84.00	336.50	566.50	725.50	537.50	334.00	19.50	**2603.50**
1988	35.50	290.50	544.50	739.50	667.50	283.00	48.00	**2608.50**
1989	21.50	202.00	456.50	648.00	535.00	315.00	167.00	**2345.00**
1990	165.50	146.00	493.50	587.50	553.50	332.50	100.50	**2379.00**
1991	144.00	423.50	541.00	641.00	567.50	289.50	114.00	**2720.50**
1992	56.00	241.50	367.00	446.50	403.50	257.50	41.50	**1813.50**
1993	23.50	208.00	430.00	642.00	613.50	184.50	25.00	**2126.50**
1994	95.50	227.50	526.50	613.50	501.50	380.00	115.00	**2459.50**
1995	3.00	221.00	536.00	698.50	745.00	225.00	125.50	**2554.00**
1996	41.00	157.00	486.00	572.00	611.00	357.50	91.50	**2316.00**
1997	27.00	48.00	534.00	596.50	443.00	299.50	134.50	**2082.50**
1998	46.00	267.00	505.50	623.50	648.00	456.00	114.00	**2660.00**
1999	49.50	299.00	578.50	684.50	500.00	339.00	67.50	**2518.00**
2000	17.00	284.00	474.50	509.50	544.50	289.00	157.00	**2275.50**
2001	78.00	289.50	504.00	649.50	654.00	282.00	114.00	**2571.00**
2002	123.00	141.50	535.00	710.00	575.00	443.00	99.00	**2626.50**
2003	66.50	147.50	410.00	606.00	608.00	312.50	82.00	**2232.50**
2004	89.00	240.50	429.50	561.00	450.50	421.50	69.00	**2261.00**
2005	58.00	145.00	623.00	647.50	611.50	429.00	130.00	**2644.00**
2006	79.00	283.50	470.50	661.00	555.50	260.00	38.50	**2348.00**
2007	53.50	277.00	534.00	564.00	594.00	393.00	231.00	**2646.50**
2008	110.00	116.50	512.00	620.00	532.50	343.00	56.50	**2290.50**
***2009**	50.50	190.00	432.00	458.50	517.50	345.00	27.00	**2020.50**
2010	89.00	368.50	528.50	729.00	697.50	311.50	95.00	**2819.00**
2011	38.00	273.00	515.00	758.50	576.50	308.50	122.50	**2592.00**
2012	28.00	341.00	555.50	756.00	552.00	295.00	109.50	**2637.00**
2013	45.50	347.50	483.50	617.00	516.00	288.00	131.50	**2429.00**
2014	45.50	271.50	536.00	488.00	525.00	285.00	74.00	**2225.00**
2015	18.00	306.00	444.50	577.00	546.50	342.00	90.50	**2324.50**
2016	37.50	274.00	509.00	688.50	680.00	430.50	189.50	**2809.00**
2017	99.50	227.50	546.00	609.50	506.00	411.50	204.50	**2604.50**
2018	14.50	417.00	509.50	664.00	649.50	422.00	115.00	**2791.50**
2019	37.00	172.50	438.00	691.00	538.50	415.50	79.00	**2371.50**
2020	24.50	253.50	560.00	750.00	628.5	305.50	55.00	**2577.00**
2021	90.00	271.00	620.50	618.00	697.00	399.50	267.00	**2963.00**
AVERAGE	**64.64**	**251.93**	**501.59**	**632.96**	**563.99**	**339.19**	**105.32**	**2459.62**

* Station moved to from Saginaw, MI to Richville, MI

2021 Seedless Pickling Cucumber Variety Trial

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A pickling cucumber variety trial was planted at the Saginaw Valley Research and Extension Center (43.399097, -83.694497, Frankenmuth, Michigan). Bejo (BJ), Nunhems (NU), Rijk Zwaan (RZ), and Sakata (SK) seed companies donated parthenocarpic (seedless) varieties for mechanical once-over harvest.

Materials and Methods

On 27 May 2021, 28 parthenocarpic pickling cucumber varieties were planted in a completely randomized block design with four replications. Seeds were pre-counted and distributed into four rows by a cone planter. Rows were 20 ft long, 20 inches on-center, with 10 inch in-row spacing targeting 40,000 seeds per acre. The soil type was a Tappan-Londo loam with a poor-moderate drainage class, typical of the pickling cucumber-growing region of Michigan's Saginaw Valley.

On 25 May 170 pounds 46-0-0 was preplant incorporated, resulting in ~152 lb N per acre. On 27 May, Curbit (ethalfluralin) and Command (clomazone) preemergent herbicides were applied at 4 pints per acre and 1 pint per acre, respectively. On 16 June, all plots were thinned to approximately 40,000 plants per acre. On 10 July, Zampro (ametoctradin + dimethomorph) and Bravo (chlorothalonil) were applied at 14 fl. oz. per acre and 1 pint per acre, respectively.

Four reps of all cultivars were harvested and measured between 19-25 July (days 53-59). We harvested 22 plants from the middle two rows of the four-row plots when the fruits began reaching advanced sizes consistently across all replications. All fruit were removed from the plants and sent through a sorter that separated and weighed them by the following sizes: 2As (1 1⁄16" – 1 ¼"), 2Bs (1 ¼" – 1 ½"), 3As (1 ½" – 1 ¾"), 3Bs (1 ¾" - 2"), and 4s (> 2" in diameter).

Length:diameter (L:D) ratios, hollow center and monkeyface percentages were measured from ten cucumbers in the 3B size class only, subsampled from a combination of all replications of a variety. Hollow centers were counted if a hole larger than 1⁄16" could be seen in the center of the seed cavity. A monkeyface was counted if holes larger than 1⁄16" could be seen along the outside of the seed cavity. Fruit per plant, bushels per acre of each size class, and combined total bushel per acre yield calculations do not include culls. We determined bushels per acre by multiplying marketable fruit per plant, plants per acre, and pounds per fruit and dividing that product by 48.

$$\frac{x\ fruit}{plant} * \frac{y\ plants}{acre} * \frac{z\ lb}{fruit} * \frac{1\ bu}{48\ lb} = \frac{bu}{ac}$$

Brinestock evaluations took place November 9. Percent recovery was calculated for each variety by longitudinally cutting 10 brined 3B pickles and tallying the number of individual fruit that were 100% usable, 90% usable, 70% usable, 50% usable, and 0% usable after running two fingers back and forth 10 times with medium pressure upon the inside seed cavity. The percent recovery is a calculation that divides the total percentage of usable pickle by the total number of pickles that were evaluated. The table below shows the datasheet format used to calculate percent recovery for each variety.

Scale	Fraction Recoverable (A)	No. of Pickles (B)	Usable Pickle (A x B)
No Defects	1.0		
	0.9		
	0.7		
	0.5		
Unusable	0.0		
	Totals		
	Total Percent Recovery (Total A x B) / Total B)		

Results and Discussion

The season was characterized by a late freeze event on May 31 that hampered seedlings and delayed overall maturity by about 10 days despite subsequent favorable temperatures, regular light rain events, and delayed downy mildew pressure (Table 1). Half of the Rijk Zwaan varieties, and all but one of the Nunhems varieties, were harvested by day 54. But the latest varieties – including BJ Aristan, RZ Gershwin, and NU V5031 – were harvested on day 59.

Total clean yield (4 + 3B + 3A + 2B + 2A) averaged 699 bu/a. The top five varieties with the highest combined clean yields of the most profitable fruit sizes (3B + 3A + 2B) were NU V5025, NU 2102, RZ 79, NU V5031, and RZ Lennon (Table 2). Of those, most had length:diameter (L:D) ratios within 1/16" of a perfect 3.0 in the 3B size class, while RZ Lennon was slightly shorter at 2.75. The five lowest yielders were BJ Absolut, SK CUZ333, BJ Aristan, SK CUCZ332, and SK CUCZ334.

Cull rates averaged 23% and were between 0% and 63.8% (Table 3). The culls were largely due to crooked and nubbed fruit. The five varieties with the lowest cull percentages were RZ 30, RZ Lennon, NU 2102, NU V5025, and RZ Liszt. The five varieties with the highest cull percentages were BJ Aristan, NU V5031, SK CUZ334, SK CUZ333, and SK CUZ332.

Total recovery rates averaged 71% (Table 3). The top five varieties each had Total Percent Recovery scores of 100%. When arranged in order of their highest combined clean yields of the most profitable fruit sizes (2B + 3A + 3B), they were NU 2106 (711 bu/a), NU 2105 (699 bu/a), RZ 16 (639 bu/a), RZ 11 (446 bu/a), and BJ Aristan (303 bu/a). Of these top briners, all achieved the average breakeven yield of 250 bu/a. When arranged in order of L:D ratio, they were NU 2106 (3.2), NU 2105 (3.0), RZ 16 (2.8), RZ 11 and BJ Aristan (2.6, but RZ 11 yielded higher). However, in a group evaluation setting with several briners and seed company reps that occurred after I gathered my data, I was made aware that my method was too aggressive, resulting in very low ratings for several varieties that the participants rated highly, namely RZ 79 and NU 2104.

Acknowledgements

Thanks to Kristin Oomen, Ken McCammon, Chris Dyk, Robert Grohs, George Pape, and Dennis Thomé at the seed companies; Paul Horny, and Dennis Fleischmann at the farm; Dave Brewer, Aaron, Joel, Tony, Todd, Mike, and others at Hausbeck's Pickle Company; and Pickle Packers International.

Table 1. Weather data summarized by weeks between 25 May and 25 July at the Saginaw Valley Research and Extension Center in 2021. Temperatures were averaged by week, and precipitation is total number of inches received for that week. *Week is reported as week of the year (week of the trial).

Week*	Max Air Temp (F)	Min Air Temp (F)	Max Soil Temp (F)	Min Soil Temp (F)	Precipitation (inches)
21 (1)	69.5	45.8	62.9	58.1	0.5
22 (2)	84.5	61.5	67.6	63.6	0.0
23 (3)	84.8	62.8	74.1	69.0	1.2
24 (4)	78.6	57.0	72.8	67.6	0.4
25 (5)	77.1	59.5	69.9	65.7	2.9
26 (6)	83.3	61.5	76.7	71.2	0.5
27 (7)	76.5	59.6	75.7	70.5	0.8
28 (8)	81.4	61.0	75.4	70.6	0.1
29 (9)	81.5	59.8	75.6	71.3	1.5
Mean	79.7	58.7	72.3	67.4	0.9
CV	10.1	15.4	6.8	7.1	101.9
Std.Error	1.0	1.1	0.6	0.6	0.3

Table 2. Yield data of 28 seedless picking cucumber varieties at the Saginaw Valley Research and Extension Center in 2021. Values in bold indicate the variety performed statistically like the variety with the highest value for that column. Data in this table are arranged in order of largest total yield in clean bushels per acre (4 + 3B + 3A + 2B + 2A).

Company and Variety	Clean Total bu/a	Clean 4 bu/a	Clean 3B bu/a	Clean 3A bu/a	Clean 2B bu/a	Clean 2A bu/a	Cull bu/a	Fruit per plant
NU 2102	**986.1**	45.6	360.2	**442.3**	121.2	16.8	69.8	3.0
NU V5025	**977.3**	26.5	311.7	**497.1**	117.4	24.6	84.6	**3.9**
RZ 20	**907.7**	**171.1**	293.4	314.6	116.9	11.6	123.0	**3.7**
RZ 79	**840.9**	19.8	**421.1**	289.4	102.9	7.7	129.3	**3.4**
NU V5031	**832.0**	104.8	**532.8**	175.7	17.8	1.0	**479.7**	2.7
RZ 2	**817.9**	**329.2**	356.7	75.3	36.4	20.2	287.5	2.7
RZ Lennon	**800.9**	49.1	**410.1**	210.9	104.2	26.6	43.1	2.9
RZ 30	**800.0**	**236.7**	330.0	164.8	49.2	19.2	25.1	2.6
NU 2104	**768.3**	15.6	272.4	334.9	111.4	33.9	152.0	3.1
RZ Bowie	**750.5**	25.8	195.9	347.8	169.2	11.8	113.1	2.8
SK XCU306	**746.0**	331.2	246.8	91.7	68.5	7.8	203.7	2.5
NU 2106	**737.7**	14.8	297.6	335.3	78.5	11.5	122.9	2.6
RZ Liszt	**730.1**	113.2	294.7	230.2	81.5	10.6	80.8	2.5
BJ 3486	696.8	141.1	293.5	206.4	55.8	0.0	131.6	2.1
NU 2105	694.9	0.0	100.7	353.2	**222.5**	18.5	99.2	3.2
RZ 16	690.9	0.0	105.8	298.4	**234.6**	52.0	77.7	**3.5**
NU 2101	673.0	0.0	62.3	283.6	**252.2**	**74.9**	93.7	3.0
RZ Gershwin	660.6	**235.8**	319.0	95.9	9.9	0.0	161.8	2.1
RZ 11	645.8	**193.8**	**389.8**	42.8	13.1	6.2	274.4	2.6
NU 2103	637.3	42.5	294.9	193.1	98.0	8.8	91.4	2.4
BJ Aristan	637.1	**326.1**	249.0	36.8	17.4	7.9	**406.7**	2.6
RZ 4	618.4	20.7	233.6	190.5	145.3	28.3	118.2	2.5
BJ Amarok	608.3	36.5	256.9	211.2	96.1	7.6	73.3	2.9
BJ Absolut	534.2	**155.5**	177.5	173.5	25.3	2.4	77.4	2.1
RZ Rubinstein	502.8	18.1	189.6	244.8	49.5	0.8	95.2	2.2
SK CUZ334	469.6	**241.4**	150.1	43.7	25.9	8.5	240.5	1.8
SK CUZ333	427.2	117.2	191.7	85.1	30.2	3.0	193.1	1.2
SK CUZ332	367.3	90.5	94.6	44.7	103.6	33.9	162.9	1.7
MS Error	33531.4	16087.8	13155.5	6450.6	1710.5	129.5	5680.0	0.1
Residual Df	81	81	81	81	81	81	81	81
Mean	698.5	110.8	265.4	214.8	91.2	16.3	150.4	2.7
CV	26.2	114.5	43.2	37.4	45.3	69.9	50.1	13.0
t.value	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990
LSD	257.6	178.5	161.4	113.0	58.2	16.0	106.0	0.5
Std.Error	91.6	63.4	57.3	40.2	20.7	5.7	37.7	0.2

Table 3. Quality data of 28 seedless picking cucumber varieties planted at the Saginaw Valley Research and Extension Center in 2021. Values are averaged across four replicates. No statistics were performed on quality data. Data in this table are arranged as an extension of Table 1 and are sorted in order of largest total yield in clean bushels per acre (4 + 3B + 3A + 2B + 2A). *The methods used for recovery data were later deemed too aggressive, and actual recovery percentages are likely higher.

Company and Variety	L:D 3B	% Hollow	% Monkey face	% Cull	Days after planting	Harvest population	Total % Recovery*
NU 2102	3.1	0.0	10.0	10.2	53.0	45837.5	7.0
NU V5025	3.0	0.0	0.0	14.4	54.0	40337.0	42.0
RZ 20	3.0	0.0	50.0	15.6	54.0	40337.0	18.2
RZ 79	2.9	0.0	0.0	17.7	53.0	36670.0	5.0
NU V5031	2.9	0.0	0.0	66.6	59.0	42170.5	10.0
RZ 2	2.5	0.0	10.0	30.3	59.0	40337.0	76.0
RZ Lennon	2.8	0.0	0.0	6.0	53.0	42170.5	72.2
RZ 30	2.6	0.0	10.0	17.9	56.0	38503.5	85.0
NU 2104	2.9	0.0	0.0	29.8	53.0	40337.0	0.0
RZ Bowie	2.8	0.0	70.0	25.4	56.0	44004.0	83.0
SK XCU306	2.7	0.0	10.0	24.5	59.0	40337.0	90.0
NU 2106	3.2	0.0	20.0	22.4	54.0	40337.0	100.0
RZ Liszt	2.8	0.0	0.0	10.8	53.0	45837.5	93.0
BJ 3486	2.9	0.0	10.0	30.3	56.0	42170.5	84.0
NU 2105	3.0	0.0	0.0	22.2	54.0	41559.3	100.0
RZ 16	2.8	0.0	90.0	21.8	54.0	42170.5	100.0
NU 2101	3.1	0.0	11.1	19.7	53.0	44004.0	30.0
RZ Gershwin	2.8	0.0	0.0	44.0	59.0	36670.0	95.0
RZ 11	2.6	0.0	0.0	44.9	59.0	38503.5	100.0
NU 2103	2.8	0.0	0.0	17.8	54.0	40337.0	97.0
BJ Aristan	2.6	0.0	0.0	31.2	59.0	34836.5	100.0
RZ 4	2.7	0.0	10.0	6.1	53.0	40337.0	82.0
BJ Amarok	2.5	0.0	70.0	11.6	54.0	40337.0	87.0
BJ Absolut	2.6	0.0	20.0	15.3	56.0	40337.0	74.0
RZ Rubinstein	2.7	0.0	50.0	22.6	56.0	36670.0	84.0
SK CUZ334	2.6	0.0	10.0	49.8	56.0	42170.5	94.0
SK CUZ333	3.0	0.0	20.0	37.0	56.0	49504.5	83.3
SK CUZ332	3.0	0.0	20.0	44.4	59.0	38503.5	93.8
Mean	2.8	0.0	17.5	25.3	55.5	40904.5	70.9
CV	6.8	0.0	139.9	63.8	4.1	14.1	47.2
Std.Error	0.0	0.0	2.3	1.5	0.2	546.8	3.2

Title: Evaluating the Role of Seed Placement and Planting Strategies in Optimizing Yield, Quality, and Profitability in Wheat

MWP Tracking Number: 20-08-05-AS

Researchers:
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Date: December 19, 2021

Project goals and value for Michigan Wheat Growers
There is interest in evaluating the benefit of precision planting technology for improved seed placement in small grains production compared to the use of conventional seed drill. However, broadcast incorporation of wheat seed for faster planting has gained some traction in recent years with no publicly available data on its performance. Farmers are also trying to figure out the best configurations for current precision planters they have on their farms. This project builds on recently concluded research by expanding the equipment used and using commercial farms instead of small plots. Growers will learn about various planting technologies and their performance (e.g. speed of operation, accuracy, yield potential). Additionally, benefits of precise seed placement will be evaluated in small plot research, along with varietal use, time of planting, and optimum seeding rates.

Results of Project
The results presented below represent the highlights of the findings from this project to date. A great deal of data collection has been, and is continuing to be, conducted, and analysis and synthesis of this data is an ongoing process. Data was analyzed in SAS software using $\alpha = 0.10$, meaning a 90% confidence level.

The first objective for this project was to compare seed placement accuracy and yield between commonly used (conventional drill, broadcast incorporation) and precision (i.e. Monosem precision planter) planting technologies. We broke this objective down into three sub-objectives:

Compare precision planter to traditional drill.
Compare broadcast incorporation to traditional drill.
Compare higher vs. lower seeding rates for broadcast incorporation.

We expected that seed placement (specifically depth) would be most variable with broadcast incorporation and least variable with precision planting. We further anticipated that this would correlate to a higher yield with precision planting and a lower yield with broadcast incorporation when compared against the traditional grain drill. The seeding rate component for broadcast incorporation was included to see if increasing the seeding rate would make up for yield potential lost due to seeds being planted too deep or too shallow with the increased variability of broadcast incorporation.

This study was conducted on five Michigan farms, with 2–5 farms per sub-objective, depending on farmer interests and space/equipment availability. The results showed that there was no significant difference in depth variability when comparing precision planting vs. drill, though precision planting did result in numerically lower variability at each of the three locations where it was used. On the other hand, we did see a 16–35% increase in variability with broadcast incorporation compared to the grain drill, which was significant at four of the five locations (Figure 1).

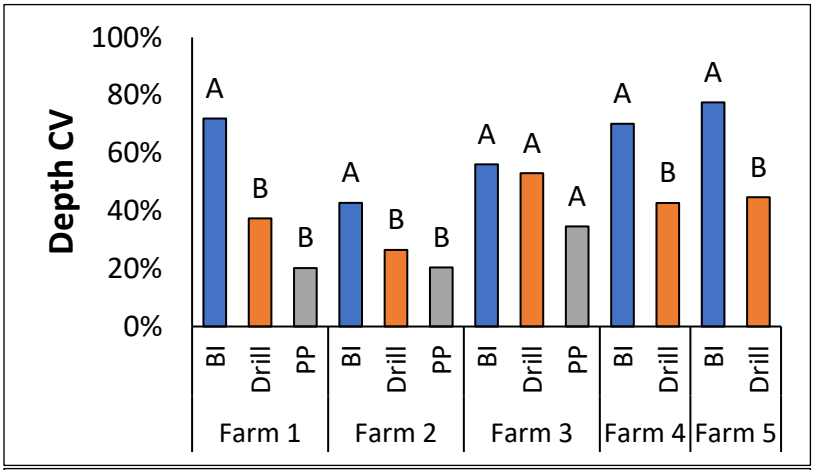

Figure 1: Depth variability, measured by coefficient of variation (CV) for broadcast incorporation (BI), drill, and precision planter (PP). Bars with the same letter within a farm are not significantly different.

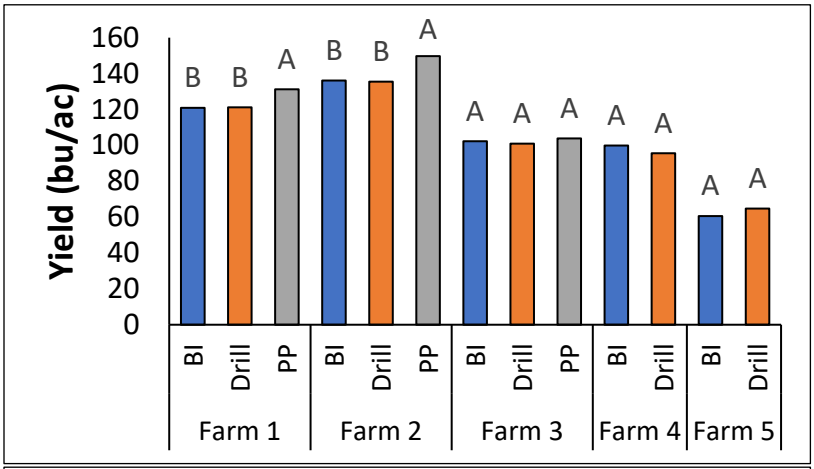

Figure 2: Yield, in bushels per acre, for broadcast incorporation (BI), drill, and precision planter (PP). Bars with the same letter within a farm are not significantly different.

In terms of yield effects, we saw an 8–11% increase in yield with precision planting over drill that was significant at two of three locations; but comparing broadcast incorporation against drill exhibited no significant yield difference (Figure 2). We found that the number of tillers per acre was consistently higher with broadcast incorporation than with drill, and this difference was significant (24–37% difference) at two of five locations (Figure 3). We think the increased tillering may have made up for any yield loss that might otherwise have occurred due to increased variability in broadcast incorporation. Seeding rate in broadcast incorporation also did not have a significant effect on yield.

The second objective was to quantify the role of seeding depth on stand establishment and tillering potential among diverse winter wheat cultivars at low and high seeding rates. The seeding rate component was left out last year but has been added for the current growing season. In the 2021 growing season, we saw the highest yield from a seeding depth of 1.5 inches and the lowest yield from a seeding depth of 0.5 inches. The 1.5- and 2.5-inch seeding depths were not significantly

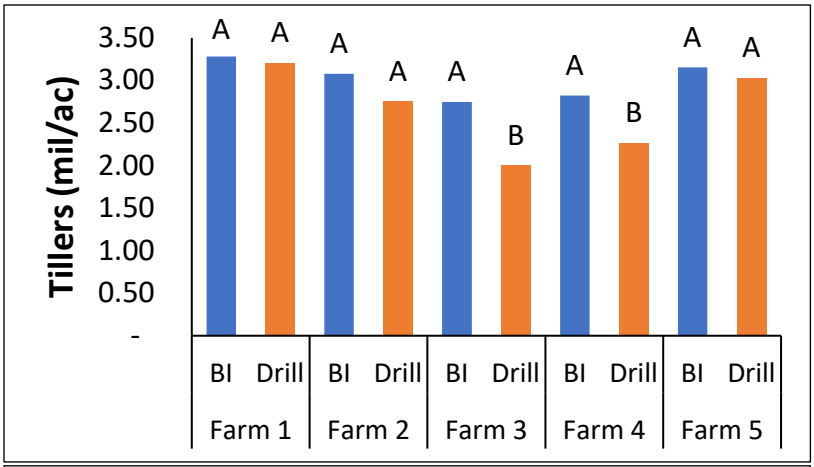

Figure 3: Tillers per acre at harvest for broadcast incorporation (BI) and drill. Bars with the same letter within a farm are not significantly different.

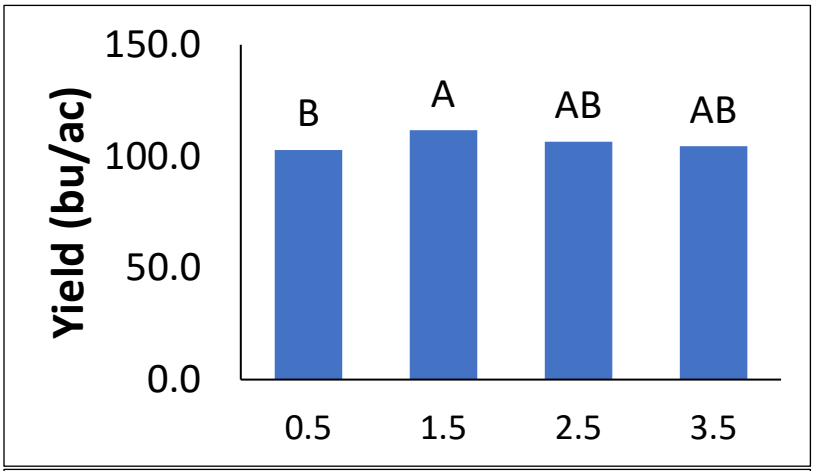

Figure 4: Yield, in bushels per acre, for various seeding depths. Bars with the same letter are not significantly different.

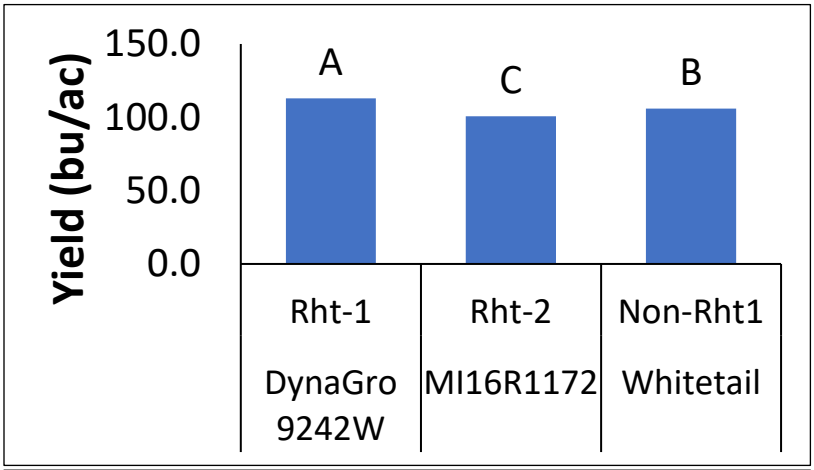

Figure 5: Yield, in bushels per acre, for various varieties with different dwarfing genes. Bars with the same letter are not significantly different.

different from each other or either of the other two seeding depths. We think the reason for the drop in yield with shallow depth may have been due to reduced moisture at this depth. We should also note that seeding depth measurements showed that we were not actually able to achieve anything deeper than a 2.6-inch seeding depth.

Comparing varieties with different coleoptile lengths, we saw the highest yield with the Rht-1 dwarfing gene and the lowest yield with the Rht-2 dwarfing gene. We did not find that coleoptile length had any impact on optimal seeding depth.

The third objective was to evaluate the impact of planting date and seeding rate on stand establishment, phenological development, and grain yield in winter wheat. We anticipated that a shorter grain fill period under late planting would reduce yield potential, while higher seeding rates would result in higher yields, especially with later planting. We did not, however, see an interaction between planting date and seeding rate during either the 2019–20 ($p = 0.83$) or the 2020–21 ($p = 0.92$) growing seasons, suggesting that optimal seeding rate is not affected by planting date. In both years, yield declined with later planting (Figure 6). However, the rate of yield loss

decreased with later planting in 2019–20 and increased with later planting in 2020–21. The rate of decline in yield from September planting was lower in 2019–20 compared to 2020–21, possibly due to higher temperatures and more precipitation over the winter allowing for better development of later-planted wheat. Weather data shows temperatures levelled off in November 2019; whereas in 2020–21 they continued to decline through February. This may have contributed to the declining yield loss rate with delayed planting in 2019–20. Another factor to consider is that the first two planting dates in 2020–21 reached canopy closure (measured using the Canopeo® developed by Oklahoma State University) more quickly, while later planting dates may not have fully closed. Canopeo measurements also gave lower readings in mid-May that corresponded with an extended period of limited rainfall and are likely the result of drought stress in plants. Plants later recovered once rain returned. The first two planting dates showed minimal effect, while the last two planting dates were most affected and likely never fully recovered afterward. While canopy closure data was not collected in 2019–20, we think this drought stress was likely not such a big factor, resulting in more complete canopy closure in later planting dates and subsequently less yield loss with delayed planting.

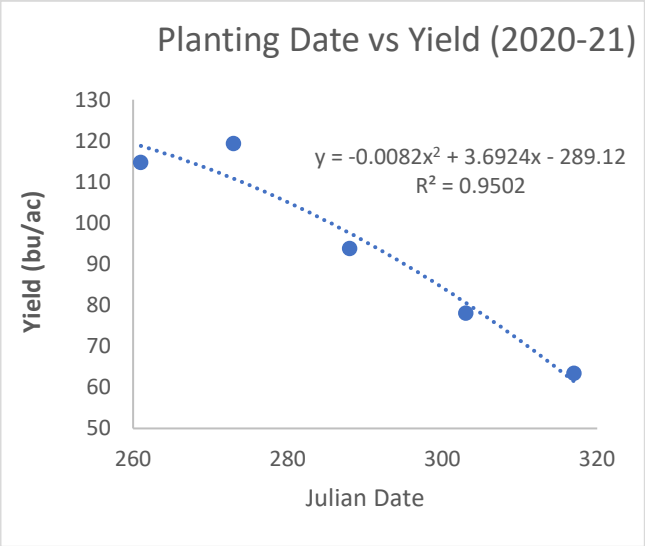

Figure 6. Yield (bu/ac) decreased with later planting dates in 2019–20 and 2020–21.

The agronomically optimal seeding rate based on ANOVA was 2.0 million seeds per acre in 2019–20 and 1.2 million seeds per acre in 2020–21. Differences between seeding rates greater than 1.2 million were minimal and associated with a high degree of variability. The linear regression model for seeding rate response was significant in 2019–20 but not in 2020–21.

Summary

Broadcast incorporation has shown potential as a means to successfully establish a stand of winter wheat. Plants planted with this method were able to establish more tillers to compensate for high variability in seeding depth. Monosem precision planting continues to lead other planting methods with the highest yields. Conducting on-farm research using farmers' equipment in tandem with small-plot research has added a new dimension to this research, bringing more site-years of data together more quickly. Planting dates and seeding rates do not appear to be connected as previously thought. Earlier-planted wheat has higher yield potential. Planting too shallow or too deep can reduce yield potential. More sites years of data are needed to draw conclusions and develop new extension recommendations for farmers regarding planting equipment, seeding dates, seeding rates and planting depth. This project is on track to generate the data needed.

Future Work
This research was made possible by a collaboration between the Michigan Wheat Program and MSU Project GREEEN. This is an ongoing project that is expected to continue for the next two growing seasons.

Project Changes
This year, we will be adding some data points to each of the studies included in this project. For the planting methods comparison, we will be comparing spatial uniformity on a 2-dimensional grid between each of the planting methods, and we are increasing our sample size for seeding depth measurements. We also planted one of our locations in early November to see how the planting methods compare under a late planting scenario. For the seeding depth study, we added a seeding rate component, which was left out last year, comparing 0.7 vs. 1.4 million seeds per acre. We also did emergence ratings to see how seeding depth affects the rate of emergence and will also be comparing canopy closure between the various seeding rates.

Budget Narrative

Intellectual Property
None.

Approach to Disseminate Research
Two extension articles have been published so far using the findings from this research. Data from this project was also presented at the American Society of Agronomy's 2021 annual meeting. Research results will be posted on the MSU Wheat and Agronomy webpages, as well as presented at winter grower meetings and field days. An article for the Wheat Wisdom newsletter can be submitted in any month.

MICHIGAN STATE UNIVERSITY EXTENSION

AgBioResearch MICHIGAN STATE UNIVERSITY

Start Right to Finish Well: Wheat Grain and Straw Production - Year 2
2021 Report to the Michigan Wheat Program

Participating PI's/Co PI's: Kurt Steinke, Associate Professor, Dept. of Plant, Soil, and Microbial Sciences, Michigan State University, East Lansing, MI.
Lacie Thomas, Graduate Research Assistant (M.S.) Michigan State University

Location: Lansing, MI	**Tillage**: Conventional
Planting Date: September 22, 2020	**Nitrogen Rates**: 50, 100, 150 lbs. N/A
Soil Type: Conover Loam; 6.8 pH, 12.3 meq $100g^{-1}$ CEC, 3.1% OM, 35 ppm P (Bray P-1), 8 ppm S, 3.1 ppm Zn	**Population**: 1.8 million seeds/A
Variety: Flipper & Red Dragon (SRWW)	**Replicated**: 4 replications

Location: Richville, MI	**Tillage**: Conventional
Planting Date: September 24, 2020	**Nitrogen Rates**: 60, 120, 180 lbs. N/A
Soil Type: Tappan-Londo Loam; 7.4 pH, 15.8 meq $100g^{-1}$ CEC 2.4% OM, 21 ppm P (Olsen P) 7 ppm S, 4.1 ppm Zn	**Population**: 1.8 million seeds/A
Variety: Jupiter & AC Mountain (SWWW)	**Replicated**: 4 replications

Introduction:

Increases in wheat (*Triticum aestivum* L.) grain and straw yield along with heightened awareness of soil spatial variability have motivated growers to focus on season-long soil nutrient availability. Michigan produces some of the nation's greatest wheat yields averaging between 75-81 bu A^{-1} in 2020-2021 (USDA-NASS, 2020-2021). As the demand for wheat straw increases (e.g., livestock bedding, feed, and biofuel), management strategies that consider both grain yield and straw production will be critical to the economic return for Michigan wheat growers.

Previous studies indicate a positive correlation between wheat yield and biomass production. For maximum production, methods of determining N fertilization rates in winter wheat are often based on fixed N removal rates per unit of produced grain and projected yield goals (Lukina et al., 2001). Nitrogen deficiency during establishment may result in reduced tiller counts and growth rates setting limitations on grain yield and biomass production before initiating primary development (Zhang et al., 2020). Application of autumn starter provides greater nutrient availability during early crop development stages thus impacting yield potential (Nkebiwe et al., 2016; Steinke et al., 2021). To promote autumn tillering and stand establishment, 25 lb N A^{-1} may be utilized in Michigan winter wheat production (Warncke et

al., 2009). Autumn starter recommendations are impacted by residual soil nitrate levels which may depend on crop rotation, diversity, and frequency (Mourtzinis et al., 2017).

Variety selection is an important management strategy for achieving high yielding grain but among small grain cereals increases in yield potential have primarily come from improved harvest index through shorter plants thus potentially at the expense of straw production. Taller wheat varieties are better suited for stressed environments due to improved emergence and harvestability. However, selecting varieties less susceptible to lodging and shattering is important to both grain and straw production (Klein, 2007). Although, short statured varieties are often overlooked for straw production, responses to input manipulation have overcome limitations specific to wheat variety and environmental conditions (Beuerlein et al., 1989; Karlen & Gooden, 1990).

Objective and Hypothesis:

Objective: Evaluate soft red winter wheat (SRWW) and soft white winter wheat (SWWW) grain and straw yield response to autumn applied starter fertilizer, spring N, and varietal stature. Our *working* hypothesis is that autumn-applied starter fertilizer will increase wheat stand resilience (soil-test dependent) prior to spring greenup for improved grain yield, straw production, and grower profitability.

Methods and Procedures:

A randomized complete block split-plot design with four replications was used to evaluate three 12-40-0-10S-1Zn autumn starter rates, three spring N rates, and two varietal statures (Table 1, 2). Main plots consisted of three rates of autumn starter fertilizer while sub-plots consisted of three spring N rates. The untreated check containing no fertilizer or additional inputs was not included in statistical analysis.

Variety stature was an additional component of this study. One short statured SRWW variety (i.e., ‘Flipper’) and one tall statured SRWW variety (i.e., ‘Red Dragon’) were selected to evaluate autumn starter implications on plant height and biomass production in Lansing, MI. One short statured SWWW variety (i.e., ‘Jupiter’) and one tall statured SWWW variety (i.e., ‘AC Mountain’) were selected for Richville, MI.

Table 1. Overview of split plot trial design, treatment names, and inputs applied to soft red winter wheat, Lansing, MI 2020 and 2021.

		------Autumn Starter and Spring Nitrogen (N)	
Treatment	**Treatment Name**	**Rate† 12-40-0-10S-1Zn**	**Rate‡ UAN (28%)**
1	No Starter, Low N	0 lb A^{-1}	50 lb A^{-1}
2	No Starter, Base N	0 lb A^{-1}	100 lb A^{-1}
3	No Starter, High N	0 lb A^{-1}	150 lb A^{-1}
4	Mid Starter, Low N	125 lb A^{-1}	50 lb A^{-1}
5	Mid Starter, Base N	125 lb A^{-1}	100 lb A^{-1}
6	Mid Starter, High N	125 lb A^{-1}	150 lb A^{-1}
7	High Starter, Low N	250 lb A^{-1}	50 lb A^{-1}
8	High Starter, Base N	250 lb A^{-1}	100 lb A^{-1}
9	High Starter, High N	250 lb A^{-1}	150 lb A^{-1}
10	**Check**		

† Autumn starter (12-40-0-10S-1Zn) applied as top-dress application 6 Oct. 2020.
‡ Spring nitrogen (UAN 28%) applied at green-up 23 Mar. 2021.

Table 2. Overview of split plot trial design, treatment names, and inputs applied to soft white winter wheat, Richville, MI 2020 and 2021.

		------Autumn Starter and Spring Nitrogen (N)	
Treatment	**Treatment Name**	**Rate† 12-40-0-10S-1Zn**	**Rate‡ UAN (28%)**
1	No Starter, Low N	0 lb A^{-1}	60 lb A^{-1}
2	No Starter, Base N	0 lb A^{-1}	120 lb A^{-1}
3	No Starter, High N	0 lb A^{-1}	180 lb A^{-1}
4	Mid Starter, Low N	125 lb A^{-1}	60 lb A^{-1}
5	Mid Starter, Base N	125 lb A^{-1}	120 lb A^{-1}
6	Mid Starter, High N	125 lb A^{-1}	180 lb A^{-1}
7	High Starter, Low N	250 lb A^{-1}	60 lb A^{-1}
8	High Starter, Base N	250 lb A^{-1}	120 lb A^{-1}
9	High Starter, High N	250 lb A^{-1}	180 lb A^{-1}
10	**Check**		

† Autumn starter (12-40-0-10S-1Zn) applied as top-dress application 6 Oct. 2020.
‡ Spring nitrogen (UAN 28%) applied at green-up 30 Mar. 2021.

Results and Discussion (2020-2021):

Soft Red Winter Wheat Yield

Autumn starter fertilizer and spring N interacted to affect both grain and straw yield in SRWW variety 'Flipper' (Table 3 & 4). The high starter, low nitrogen treatment resulted in an increase of 22.5 bu A^{-1} as compared to the no starter, high N treatment (Table 3). No significant difference in straw yield occurred between mid-autumn starter, base or high N as compared to

no autumn starter, base or high N treatments (Table 4). However, straw yield increased 0.89 T A^{-1} with the high autumn starter, low N treatment as compared to no autumn starter, low N treatment in 2021. Main effects of autumn starter increased both grain and straw yield in tall-statured 'Red Dragon' by 17.2 bu A^{-1} and 0.34 T A^{-1}, respectively in 2021 (Table 3 & 4). Tiller development was significantly greater with high application of autumn starter for 'Red Dragon' (Table 10). Optimal fertilization can promote tiller production and increase the number of stems for grain and straw yield potential. Increase in biomass of productive stems is closely related to grain per gram of spike and can result in greater yield efficiency (Slafer et al., 2015).

Soft White Winter Wheat Yield

The high rate of autumn starter increased 'Jupiter' grain yield compared to no starter but yield was similar to the mid starter application rate (Table 5). Application of autumn starter resulted in a 19.8 bu A^{-1} and 0.77 T A^{-1} increase in grain and straw yield, respectively (Table 5 & 6). High spring N increased grain yield by 3.3 and 11.5 bu A^{-1} as compared to the base and low spring N rates. Additionally, autumn starter and spring N interacted to affect grain yield in 'AC Mountain' (Table 5). The high autumn starter, base spring N was the highest yielding treatment and increased production by 16.7 bu A^{-1} as compared to no autumn starter, base spring N. There was no significant increase in grain yield between no, mid, or high autumn starter in combination with high spring N. Straw yield for 'AC Mountain' increased with application of autumn starter (Table 6). Base and high spring N application increased straw yield by 0.28 T A^{-1}. Application of autumn starter positively impacted tiller production in both SRWW varieties. Greatest tiller establishment in 'AC Mountain' occurred with high autumn starter. Tiller counts were similar for 'Jupiter' with mid and high autumn starter increasing tillers as compared to no autumn starter.

Profitability

Net profitability analysis of grain and straw yield was conducted to evaluate SRWW and SWWW return on investment (Table 3,4,5,6). Local grain and straw market price, total treatment cost, and harvest cost (i.e., threshing and baling) were assessed to determine the estimated net return based on observed yields. Net grain yield profitability was highest in SRWW variety 'Flipper' with the high starter, low N treatment but was not significantly different from any combination of mid or high starter, spring N application (Table 3). When including net straw profitability, high starter, low and high N treatments yielded the greatest return, but were not significantly greater than any combination of mid starter, spring N treatment (Table 4). In SRWW variety 'Red Dragon,' application of autumn starter increased both grain and straw yield profitability. Additionally, mid-autumn starter did not significantly differ from high autumn starter (Table 3 &4). In SWWW variety 'AC Mountain' autumn starter and spring N interacted to affect grain yield profitability with high starter, base N as the most profitable treatment (Table 5). With inclusion of straw yield, increased net profit was driven by application of base spring N rate. Grain yield profitability individually and grain + straw yield profitability were both driven by mid-autumn starter application rates or greater for SWWW

variety ‘Jupiter’ (Table 5 & 6). Net profitability decreased with low spring N application as compared to base and high spring N rates for both grain and straw yield net profitability.

Straw nutrient removal is an important factor influencing economic return of straw production. The average straw fertilizer equivalent is 13.0-16.2 lbs T^{-1} N, 2.4-3.3 lbs T^{-1} P_2O_5, 23.0-26.8 lbs T^{-1} K_2O, and 0.8 lbs T^{-1} sulfur (S) (Culman et al., 2020; Reiter et al., 2015; Warncke et al., 2009). In 2021, straw nutrient removal values for SRWW and SWWW varieties were lower than average for N, P_2O_5, and K_2O with slightly above average S removal (Table 7 & 8). For SRWW, nutrient removal was greatest for N and P_2O_5 with the no starter, high N treatment (Table 7). No significant difference was observed in K_2O removal across any autumn starter or spring N treatment. Sulfur removal was greatest with high autumn starter and high spring N. In SWWW, removal of N, P_2O_5, and K_2O was not affected by autumn starter application (Table 8). S removal was highest with the inclusion of autumn starter. High spring N resulted in the greatest removal of all nutrients.

Pre plant K was 99-166 ppm, exceeding critical levels for Lansing and Richville, respectively. The uptake rate of K increases in the period of resuming growth to booting stage with peak uptake at full to end of flowering (Ali et al., 2019; Malhi et al., 2011). April and May cumulative rainfall differed by -48 and -72% in Lansing and -75 and -65% in Richville, respectively from the 30-yr mean in 2021. Lack of soil moisture throughout vegetative and flowering stages likely reduced K accessibility for uptake resulting in no change of K_2O removal by treatment. An overall increase in nutrient removal was consistent with above recommended N rates (i.e., additional N application drove additional nutrient removal). Differences in N and S uptake may be driven by nutrient availability (i.e. fertilizer application) while changes in uptake of P and K may be attributed to changes in shoot biomass (Silva et al., 2021).

Optimum nutrient management is essential to reduce nutrient losses to the environment and to improve nutrient use efficiency (i.e., yield per unit of fertilizer applied) (Silva et al., 2021). Elevated fertility costs increase the importance of site-specific nutrient management and application efficiency. Oct. 2021 mean price per pound of N, K_2O, and P_2O_5 increased 25-110% as compared to Oct. 2019 values (Table 9). Continued increase in fertilizer pricing combined with decreased availability drives the economic importance for precise, timely, and soil-test based application of autumn starter and spring N to maximize net profitability.

Table 3. SRWW mean grain yield and net profitability analysis**.**

Treatment	Flipper		Treatment	Red Dragon	
	--Bu A^{-1}--	--US$ A^{-1}--		--Bu A^{-1}--	--US$ A^{-1}--
No Starter, Low N	90.6 ef	$508.84 b	No Starter	71.4 b	$362.52 b
No Starter, Base N	98.3 de	$531.41 ab	Mid Starter	88.6 a	$439.21 a
No Starter, High N	88.6 f	$444.15 c	High Starter	92.3 a	$431.55 a
Mid Starter, Low N	106.7 bcd	$578.97 a	*Pr > F*	< 0.01	= 0.05
Mid Starter, Base N	104.0 cd	$536.14 ab			
Mid Starter, High N	113.8 ab	$571.42 ab	Low N	64.9 b	$316.83 b
High Starter, Low N	111.1 abc	$575.19 a	Base N	92.4 a	$463.31 a
High Starter, Base N	105.6 bcd	$514.85 ab	High N	94.9 a	$453.14 a
High Starter, High N	118.0 a	$567.06 ab	*Pr > F*	< 0.01	< 0.01
Check‡	43.7	$240.56			
$P_r > F$	= 0.04	= 0.04	Check‡	40.8	$222.38

† Values followed by the same lowercase letter are not significantly different at α=0.1
‡ Untreated check containing no fertilizer or additional inputs was not included in statistical analysis.

Table 4. SRWW mean straw yield and net profitability analysis grain & straw combined.

Treatment	Flipper		Treatment	Red Dragon	
	--T A^{-1}--	--US$ A^{-1}--		--T A^{-1}--	--US$ A^{-1}--
No Starter, Low N	1.07 c	$646.83 c	No Starter	1.07 b	$495.26 b
No Starter, Base N	1.38 bc	$712.29 bc	Mid Starter	1.41 a	$630.34 a
No Starter, High N	1.36 bc	$622.72 c	High Starter	1.53 a	$633.45 a
Mid Starter, Low N	1.48 bc	$773.62 ab	*Pr > F*	= 0.04	= 0.01
Mid Starter, Base N	1.66 ab	$756.88 ab			
Mid Starter, High N	1.54 ab	$775.67 ab	Low N	1.00 a	$450.58 b
High Starter, Low N	1.96 a	$837.14 a	Base N	1.48 a	$653.75 a
High Starter, Base N	1.52 b	$715.98 bc	High N	1.53 a	$654.73 a
High Starter, High N	2.00 a	$835.42 a	*Pr > F*	< 0.01	< 0.01
Check‡	0.53	$302.78			
$P_r > F$	= 0.04	= 0.05	Check‡	0.58	$291.60

† Values followed by the same lowercase letter are not significantly different at α=0.1
‡ Untreated check containing no fertilizer or additional inputs was not included in statistical analysis.

Table 5. SWWW mean grain yield and net profitability analysis**.**

Treatment	AC Mountain		Treatment	Jupiter	
	--Bu A^{-1}--	**--US$ A^{-1}--**		**--Bu A^{-1}--**	**--US$ A^{-1}--**
No Starter, Low N	80.5 e	$448.33 d	No Starter	83.9 b †	$438.85 b
No Starter, Base N	96.6 c	$519.53 bc	Mid Starter	103.7 a	$533.91 a
No Starter, High N	103.6 b	$533.21 ab	High Starter	108.2 a	$531.56 a
Mid Starter, Low N	88.3 d	$451.80 d	*Pr > F*	< 0.01	< 0.01
Mid Starter, Base N	105.4 b	$547.46 ab			
Mid Starter, High N	106.7 b	$521.85 bc	Low N	89.8 c	$476.60 b
High Starter, Low N	93.0 cd	$465.72 d	Base N	101.3 b	$518.98 a
High Starter, Base N	113.3 a	$564.17 a	High N	104.6 a	$508.74 a
High Starter, High N	105.5 b	$482.66 cd	*Pr > F*	< 0.01	< 0.01
Check‡	48.0	$372.34			
$P_r > F$	= 0.06	= 0.10	Check‡	52.3	$299.71

† Values followed by the same lowercase letter are not significantly different at α=0.1
‡ Untreated check containing no fertilizer or additional inputs was not included in statistical analysis.

Table 6. SWWW mean straw yield and net profitability analysis grain & straw combined.

Treatment	AC Mountain		Treatment	Jupiter	
	---T A^{-1}---	**--US $ A^{-1}---**		**--T A^{-1}--**	**--US $ A^{-1}--**
No Starter	1.34 b †	$676.18	No Starter	0.88 b	$550.43 b
Mid Starter	1.50 a	$702.21	Mid Starter	1.21 a	$690.73 a
High Starter	1.61 a	$714.57	High Starter	1.22 a	$689.77 a
Pr > F	= 0.03	NS	*Pr > F*	< 0.01	< 0.01
Low N	1.29 b	$601.62 b	Low N	0.98 b	$601.62 b
Base N	1.57 a	$665.67 a	Base N	1.13 a	$665.67 a
High N	1.59 a	$663.64 a	High N	1.19 a	$663.64 a
Pr > F	< 0.01	< 0.01	*Pr > F*	< 0.01	< 0.01
Check‡	0.80	$372.34	Check‡	0.58	$368.93

† Values followed by the same lowercase letter are not significantly different at α=0.1
‡ Untreated check containing no fertilizer or additional inputs was not included in statistical analysis.

Table 7. 2021 SRWW mean straw nutrient removal.

Treatment	Nitrogen	P_2O_5	Treatment	K_2O	Sulfur
	----------lbs T $^{-1}$----------				
No Starter, Low N	9.65 c†	2.70 bc	No Starter	12.45	0.91 b
No Starter, Base N	9.70 c	2.70 bc	Mid Starter	12.77	1.00 b
No Starter, High N	14.75 a	4.83 a	High Starter	12.77	1.18 a
Mid Starter, Low N	8.93 c	2.36 c	*Pr > F*	NS	< 0.01
Mid Starter, Base N	9.58 c	2.36 c			
Mid Starter, High N	11.50 b	2.93 b	Low N	11.84	0.97 b
High Starter, Low N	9.68 c	2.59 bc	Base N	12.92	0.94 b
High Starter, Base N	9.38 c	2.42 bc	High N	12.23	1.18 a
High Starter, High N	12.00 b	2.93 b	*Pr > F*	NS	< 0.01
Check‡					
$P_r > F$	=0.03	< 0.01	Check‡		

† Values followed by the same lowercase letter are not significantly different at α=0.1
‡ Untreated check containing no fertilizer or additional inputs was not included in statistical analysis.

Table 8. 2021 SWWW mean straw nutrient removal.

Treatment	Nitrogen	P_2O_5	K_2O	Sulfur
	----------lbs T $^{-1}$----------			
No Starter	9.63 †	1.86	19.11	0.83 b
Mid Starter	9.62	1.73	19.24	1.09 a
High Starter	9.99	1.96	19.37	1.22 a
Pr > F	NS	NS	NS	< 0.01
Low N	8.15 c	1.63 b	16.93 c	0.90 c
Base N	9.70 b	1.80 b	19.25 b	1.05 b
High N	11.38 a	2.11 a	21.54 a	1.19 a
Pr > F	< 0.01	< 0.01	< 0.01	< 0.01
Check‡				

† Values followed by the same lowercase letter are not significantly different at α=0.1
‡ Untreated check containing no fertilizer or additional inputs was not included in statistical analysis

Table 9. Mean fertilizer pricing autumn 2019 and 2021.

Product	2019	2021	Nutrient	2019	2021
	---------- $/T^{-1} ----------			---------- $/lb^{-1} ----------	
Urea 46-0-0	$485	$810	Nitrogen	$0.53	$0.88
UAN 28-0-0	$385	$475	Nitrogen	$0.68	$0.85
MAP 11-52-0	$428	$885	P_2O_5	$0.41	$0.85
MOP 0-0-60	$370	$776	K_2O	$0.31	$0.65

† Mean fertilizer price obtained from USDA Illinois Department of Agriculture Market News Report Oct. 2019 and 2021 (https://mymarketnews.ams.usda.gov/filerepo/sites/default/files/3195/2021-10-21/518047/ams_3195_00044.txt).

Table 10. Influence of autumn starter (12-40-0-10S-1Zn) on tillers ft^2.

Variety	Location	No Starter	Med Starter	High Starter	
		---------- Height cm^{-1} ----------			*Pr* > *F*
Red Dragon	Lansing	156 b	165 b	228 a	= 0.03
Flipper	Lansing	162	165	171	NS
AC Mountain	Richville	142 b	157 b	187 a	= 0.03
Jupiter	Richville	106 b	148 a	158 a	< 0.01

† Values followed by the same lowercase letter are not significantly different at α=0.1
‡ Untreated check containing no fertilizer or additional inputs was not included in statistical analysis.
€ Heights obtained from 10 plants per plot used for this analysis.

Discussion

Results from the SRWW varieties indicate application of high (i.e., above recommended) spring N did not compensate for the lack of autumn applied starter at plant establishment. When pre-plant soil nitrate concentrations are below 10 ppm (which occurred in the current study), positive yield responses to autumn N are more probable (Alley et. al., 2009). Soil nitrate concentrations were 5.9 and 3.7 ppm indicating a positive response to autumn N may be probable especially considering the timely planting. In addition to N, the interaction between sulfur and nitrogen has shown to have an impact on the physiological attributes to wheat biomass and grain yield (Salvagiotti & Miralles, 2008). Research has shown that nitrogen use efficiency can be increased when there is no sulfur deficiency of the current crop (Salvagiotti & Miralles, 2008). Pre-plant soil S levels were 7 and 8 ppm in Lansing and Richville, respectively but soil S testing may not a reliable indicator for S response. Sulfur application may be cost effective considering ~25 lbs. A^{-1} is all that may be required. The critical soil test P concentration for winter wheat is 25 ppm (Warncke et al., 2009). A high pre-plant Bray P-1 phosphorous concentration of 35 in Lansing and 21 Olsen-P in Richville reduced the likelihood of a yield response to phosphorous application.

Results from SRWW varieties ‘Flipper’ and ‘Red Dragon’ agree with (Steinke et. al, 2021) who observed a grain yield decrease of 18.7 and 37.5 bu A^{-1} when autumn starter fertilizer was removed from enhanced management and a grain yield increase from 17.4 and 25.9 bu A^{-1} when autumn starter fertilizer was added to traditional management at Richville and Lansing, MI, respectively. Low pre-plant residual nitrate concentrations, inclusion of the sulfur component, and timely autumn planting likely resulted in the positive grain and straw yield response to autumn starter fertilizer observed at this location. Be sure to consider a pre-plant nitrate test as part of a proactive approach to address soil variability. Autumn starter can help winter wheat “Start Right to Finish Well” for optimal grain and straw production but response will be field- and site-specific.

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2021 Oat Variety Trial
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An oat variety trial was planted in collaboration with General Mills Company. The purpose of this study is to evaluate oat varieties derived from across North America for their adaptation to MI growing conditions. Some of these lines were sourced from MI. This trial was planted on March 21, 2021 at a seeding rate of 1.2 million seeds per acre. 150 pounds of urea was applied prior to planting. Herbicide was not needed. Fungicide was also not needed as little to no crown rust was present. Oats were harvested on July 28. In early June, there was a dry period that moved the oats along to maturity a little quicker than normal. Rains returned in late June, causing the oats to continue tillering. This caused several "green oats" to be present at harvest. This trial is planned to be repeated again in 2022 to evaluate if oats can be a economically viable rotation crop in the thumb area.

[21 Spring GM Oats at SVREC - Spring Cereals] 21 Oats GM

Entry #	Line Name	% Moisture	Test Weight	Yield (bu/a)
1	2015Y3857	19.83	29.03	132.7
2	2017Y2658	20.40	26.47	116.6
3	2017Y2693	18.93	28.40	108.6
4	2017Y2702	19.67	27.20	112.1
5	AAC_DOUGLAS	19.33	30.46	117.5
6	Alka	14.33	31.50	146.8
7	Antigo	16.37	33.07	88.7
8	Badger	19.50	29.93	98.3
9	Betagene	19.00	28.84	103.9
10	CDC_ARBORG	16.17	29.47	111.1
11	CDC_ENDURE	19.94	28.20	134.0
12	CDC_NORSEMAN	18.30	27.70	117.5
13	CDC_SKYE	19.00	30.73	111.8
14	CS_CAMDEN	15.70	28.50	142.8
15	DEON	18.50	30.77	143.9
16	ESKER2020	16.93	26.10	97.9
17	Goliath	19.67	32.33	137.5
18	Hayden	14.27	33.60	128.7
19	Horsepower	18.73	31.13	102.5
20	IDA	19.33	28.30	125.0
21	MN_PEARL	18.36	29.33	150.1
22	ND_HEART	17.50	29.67	102.6
23	NEWBERG	16.83	30.00	108.3
24	ORe3541m	17.00	30.57	130.4
25	ORe3542m	18.43	31.40	139.9
26	OT3112	18.20	28.30	109.0
27	Reins	16.73	30.13	124.6
28	ROCKFORD	16.70	32.90	122.2
29	RON	21.97	28.00	113.5
30	Rushmore	17.27	32.86	113.7
31	SABER	15.73	30.17	132.4
32	Saddle	16.90	29.90	100.7
33	SD150012	15.90	32.13	116.2
34	SD170463	19.93	32.97	108.2
35	SUMO	18.30	29.27	102.1
36	Warrior	19.77	29.53	126.7
37	ND040341	18.17	37.77	67.9
38	SEMICAN1	18.10	28.93	103.7
39	SEMICAN2	18.47	29.33	117.2
40	STREAKER	19.30	38.10	125.5
41	2018Y1334	17.47	28.73	136.3
42	2018Y1436	18.87	26.77	103.0
43	2018Y1438	21.40	26.07	126.1
44	IL10-9872	17.33	30.03	103.3
45	IL14-2453	16.33	30.93	127.4
*	Mn	18.11	30.12	117.5
*	LSD(.05)	0.80	0.34	20.4
*	CVErr	2.72	0.69	10.7

2021 DRY BEAN YIELD TRIALS

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The dry bean-breeding program initiated its thirteenth season on the 450-acre Saginaw Valley Research & Extension Center (SVREC) research farm near Frankenmuth, MI in 2021. The program conducted 19 yield trials in ten market classes and participated in the growing and evaluation of the Cooperative Dry Bean, Midwest Regional Performance, National Drought and the National Sclerotinia Nurseries in Michigan and winter nursery in Puerto Rico. The nurseries were planted into unusually dry conditions (June 2-June 11). Bean trials received a total of 13.4" of rain following planting (June - mid Sept). The season was characterized by timely light rains after planting (1.18" June 8-14) to aid germination, followed by a dry period until significant rains (~3") fell the week of June 24-30. Early July was hot and dry during flowering, however 1.5" of precipitation fell July 24 during the critical reproductive phase of the season and signaled a shift to more frequent precipitation patterns resulting in overall above average yields. This combined with an excess of heat units and growing degree days led to atypical early maturities and dry down of the overall crop. Harvest conditions were good, with most trials harvested at or near ideal seed moisture. Root rot caused by *Rhizoctonia* strain AG2-2 caused some damage throughout the nurseries at SVREC, particularly in midsize pinto, great northern, and small red classes. While root rot caused by *Fusarium* caused more significant damage to kidney bean yield trials in Montcalm Research Center. CBB was also present on some of the plots on both research farms and notes were collected to identify those lines that showed some level of resistance. As in 2020, yields were relatively high in 2021, averaging 28-34 cwt/acre compared to average yields of 20 cwt/acre in 2019. A total of 1865 single plant selections were made in F_2 and F_4, and F_5 nurseries and these were sent to Puerto Rico for seed increase.

In contrast to previous years, an F_5 augmented yield trial and spaced-planted nurseries were grown simultaneously to catch up to breeding delays incurred in 2020 due to COVID related restrictions. Additionally, the use of unmanned aerial systems (UAS) was greatly expanded this season to explore opportunities to harness this technology to provide an affordable and efficient high-throughput phenotyping platform to improve the accuracy of selection of superior breeding lines. Black bean testing was also expanded this year by adding an additional location near Ruth to test black beans alongside the Michigan Dry Bean Performance Trials. Data collection at harvest was also improved with the addition of a Harvestmaster H2 weigh system to the combine which eliminated delays in obtaining plot weights and seed moisture. This allowed for more efficient generation of final yield data to better inform decision making for crossing.

Two 42-entry black bean trials were conducted side by side at SVREC to measure symbiotic N-fixation (SNF) of elite black bean lines. One trial received no N while the other received normal fertility of 63 lbs/acre. SPAD measurements collected using a PhotosynQ MultispeQ meter as well UAS images were collected using RGB and multispectral sensors throughout the growing season. Additionally, soil tests were collected before and after harvest. Yields in the non-fertilized trial ranged from 1.5 to 33.0 cwt/acre, mean 28.0 cwt/acre, compared to range from 3.9 to 39.2 cwt/acre, mean 32.1 cwt/acre in the fertilized trial. The non-nodulating check was the lowest yielding entry in both trials, with some lines producing consistent high yields in both trials in the absence of

applied N. This is the third year this trial has been conducted, resulting in performance of several breeding lines with equivalent yield with/without nitrogen across years, suggesting an improved nitrogen use efficiency among these lines.

Four nurseries were conducted at the Montcalm Research Farm (MRF) under irrigated conditions. These included a kidney bean trial, yellow bean trial, and the National Sclerotinia white mold trial. An additional white mold trial was grown to screen navy, black, and small red advanced breeding lines for tolerance to mold. This trial will serve a training population to evaluate and optimize genomic prediction for white mold and other agronomic traits. Plots were planted June 9, and harvest under favorable conditions. Kidney and yellow bean trials were pulled and windrowed, while white mold trials were direct harvested. Trials were located on Comden 3 field, which has not been in frequent bean production for the past 20+ years. However, torrential rains fell June 24-26 (3.88”) followed by an additional 3.9” July 6-8, which provided ideal conditions for *Fusarium* root rot infection in these nurseries in 2021. Disease pressure stunted plant growth but provided an excellent opportunity to rate disease severity across all kidney breeding lines by digging roots from border rows and assessing disease severity. Side-dress fertilizer was applied on July 12 to mitigate the loss of root function, and the field recovered to produce acceptable albeit reduced yields as compared to past years. Anthracnose Race 2 was detected again but limited to a few seed lots that originated from the farm in 2020. Two applications of Priaxor® fungicide were made July 10 and 26 to limit the secondary spread and preserve seed quality for future use. The first application was made earlier than in 2019 and 2020, and this timing appeared to be more appropriate for reducing secondary spread to adjacent plots. Emphasis will continue to be taken in 2022 to avoid seed from the few infected plots, and it appears progress was made towards better management of this destructive disease that significantly impacted nurseries in 2019 and 2020. Moreover, efforts to breed for anthracnose resistance in large-seeded beans including kidney and yellow beans continued this year by continued introgression and screening.

The data for all tests are included in an attached section. Procedures and details on nursery establishment and harvest methods are outlined on the first page. Since the data collected on each test are basically the same, a brief discussion of each variable measured is presented below for clarification purposes.

1. Yield is clean seed weight reported in hundredweight per acre (cwt/acre) standardized to 18% moisture content. Dry beans are commercially marketed in units of 100 pounds (cwt).

2. Seed weight is a measure of seed size, determined by weighing in grams a pre-counted sample of 100 seeds, known as the 100-seed weight. To convert to seeds per 100g (10,000/100 seed wt); for example, 100-seed weight of 50 converts to 200 seeds per 100 g (used in marketing).

3. Days to flower are the number of days from planting to when 50% of plants in a plot have one or more open flowers.

4. Days to maturity are the actual number of days from planting until date when all the plants in a plot have reached harvest maturity.

5. Lodging is scored from 1 to 5 where 1 is erect while 5 is prostrate or 100% lodged.

6. Height is determined at physiological maturity, from soil surface to the top of plant canopy, and is recorded in centimeters (cm).

7. Desirability score is a visual score given the plot at maturity that takes into consideration such plant traits as; moderate height, lodging resistance, good pod load, favorable pod to ground distance, uniformity of maturity, and absence of disease, if present in the nursery. The higher the score (from 1 to 7) the more desirable the variety, hence DS serves as a subjective selection index.

At the bottom of each table, the mean or average of all entries in a test is given to facilitate comparisons between varieties. To better interpret data, certain statistical factors are used. The LSD value refers to the Least Significant Difference between entries in a test. The LSD value is the minimum difference by which two entries must differ before they can be considered significantly different. Two entries differing in yield by 1 cwt/acre cannot be considered as performing significantly different if the LSD value is greater than 1 cwt/ acre. Such a statement is actually a statement of "probable" difference. We could be wrong once in 20 times ($p=0.05$) on the average, depending on the level of probability. The other statistic, Coefficient of Variation (CV), indicates how good the test was in terms of controlling error variance due to soil or other differences within a location. Since it is impossible to control all variability, a CV value of 10% or less implies excellent error control and is reflected in lower LSD values. Under the pedigree column, all released or named varieties are **bolded** and always preceded by a comma (,); when preceded by a slash (/), the variety was used only as a parent to produce that particular breeding line.

Expt. 2101: Standard Black Bean Yield Trial -N

This trial was planted without the application of any nitrogen (N) fertilizer. This 42-entry trial included the same standard commercial black bean varieties and advanced breeding lines as test 2102 and 2119. Yields ranged from 1.5 to 33.0 cwt/acre with a test mean of 28.0 cwt/acre. Variability was low in this test, (CV=9.1%) and the LSD was 3.0 cwt/acre. Eleven entries significantly out yielded the test mean which included B16504 for the sixth and B19309 for the second consecutive years. Adams was the only variety in this group. Several promising B20 breeding lines with good canning quality, high levels of CBB resistance, and upright architecture also showed excellent yield potential in their first year of testing in the absence of N fertilizer. Zenith ranked slightly above the trial mean, Zorro slightly below, while private varieties Black Bear, Eclipse, Nimbus, and Black Beard grouped at the bottom of the trial producing yields of only 22-25 cwt/a as result of low fertility and susceptibility to CBB These results suggest that MSU breeding lines can perform well under low fertility and high CBB pressure relative to private entries. As expected, the non-nodulating line R99 that does not fix N was the lowest yielding entry in the test. It failed to set many pods and mature normally in this trial in contrast to test 2102 where it did pod and dry down, similar to 2020 results. It was encouraging to see several lines continue to perform well in the absence of additional N suggesting they have improved N-fixation capacity. Given environmental concerns as well as increasing fertilizer costs, there exists a need to identify lines that naturally fix higher levels of N that partitions efficiently to yield. This trait could also be advantageous to organic producers who are limited in forms of N they may apply.

Expt. 2102: Standard Black Bean Yield Trial +N

This 42-entry trial included the same standard commercial black bean varieties and advanced breeding lines as test 2101. The trial was planted with standard nitrogen (N) treatment of 63 lbs/acre. Yields ranged from 3.9 to 39.2 cwt/acre with a test mean of 32.1 cwt/acre. Variability was low in this test, (CV=9.5%) and the LSD was 3.5 cwt/acre. Six entries significantly out yielded the test mean including the recent MSU release Adams at 36.1 cwt/acre. It was encouraging to see B20599, B16504, B20591, Adams, B20590, B19309, B20597 rank in the top ten of both +/- N trials. Zenith performed near the mean at 32.9cwt, while Nimbus, Eclipse, Zorro, Black Beard and Black Bear all ranked below the test mean in contrast to 2020 results. Black Beard and Black Bear were severely infected with CBB and were therefore the lowest yielding varieties. The non-nodulating line R99 that does not fix N was the lowest yielding entry in the test yet yielded more than 160% better than in test 2101 suggesting that N-fixation was an important contributor to yield in the low N trial. The goal of these paired trials is to improve overall nitrogen use efficiency of black beans by identifying lines that perform similar or better without the addition of nitrogen fertilizer. Canning tests will be conducted on new breeding lines to ensure only those with canning quality equivalent or better than Zenith are advanced.

Expt. 2103: Preliminary Black Bean Yield Trial

This 32-entry trial included new black bean lines (B21-prefix) and check varieties. Yields ranged from 27.8 to 37.7 cwt/acre with a mean of 33.7 cwt/acre. Variability was very well controlled (CV=6.5%) producing an LSD of 3.0 cwt/acre. Adams was the top yielding variety at 35.3 cwt/a as in the previous two black bean trials, followed by Zenith and Zorro. In contrast, Nimbus and

Black Bear were the lowest yielding entries in the trial, due in part to their total susceptibility to CBB. This continues to be a challenge when including some newer private commercial varieties as checks, since there is always some level of CBB in MI grown seed. Despite sourcing clean western seed of all check varieties, their performance is increasingly being confounded by CBB infection in recent years. A similar situation exists in navy bean trials. Two new lines significantly exceeded the yield of Adams, suggesting continued yield gains in this class. All entries will be canned and only those with acceptable quality will be advanced to further testing in 2022.

Expt. 2104: Standard Navy Bean Yield Trial

This 36-entry trial included standard commercial navy bean varieties, and advanced lines from the MSU breeding program, which carry the N-prefix. Yields ranged from 20.1 to 32.9 cwt/acre with a mean of 27.9 cwt/acre. Variability in this trial was low (CV= 6.8%) and the LSD needed for significance was 3.2 cwt/acre. Six breeding lines significantly out-yielded the test mean although the overall navy yields were lower compared to those of black beans, which contrasted with 2020 results. Four of these were progeny of navy/black crosses, suggesting that using higher yielding black beans to improve navy bean yield has been an effective breeding strategy to improve this market class. It was similarly encouraging that these lines were some of the top yielding entries from the 2020 preliminary navy trial. Valiant was the top commercial variety in the trial for the second year at 26.5 cwt/acre, although it performed below the trial mean. Alpena produced similar yield of 25.4 cwt. Common bacterial blight (CBB) was a significant factor in the underperformance of the remaining varieties, including HMS Bounty, Merlin, and Medalist which were three of the six lowest yielding entries. This disease pressure did allow for useful screening of breeding lines. Canning tests will be conducted on all entries before being considered for advance.

Expt. 2105: Preliminary Navy Bean Yield Trial

This 40-entry trial included new navy bean lines (N21-prefix) and check varieties. Yields ranged from 23.2 to 37.5 cwt/acre with a mean of 31.3 cwt/acre. Variability among experimental entries was low (CV=9.0%) with an LSD of 3.8 cwt/acre. Four new lines significantly exceeded the test mean, and all of these exceeded the yields of the corresponding group in test 2104 which suggests genetic progress in yield potential. It is interesting to see common parents among the top yielding lines in both trials, although there was less black bean parentage in pedigrees at the top of 2105. Merlin was the top check variety at 29.6 cwt, followed by Alpena, newly released ND Polar from NDSU program, and HMS Bounty. Valiant was the lowest yielding entry at 23.2 cwt, again due in part to CBB infection, which contrasts with results in 2104 where it was highest check. All entries will be canned and evaluated. As in recent years, concerns also exist over small seed size (<18g/100 seed) of several of the entries. Future advances will depend on the favorable combination of acceptable seed size, desirable upright architecture, confirmation of disease reactions, and canning quality.

Expt. 2106: Standard Great Northern Yield Trial

This 36-entry trial included MSU great northern breeding lines (G-prefix) and standard commercial check varieties. The test ranged in yield from 22.2 to 36.3 cwt/acre with a mean yield of 31.1 cwt/acre. Variability was moderate (CV= 9.9%) resulting in an LSD value of 3.6 cwt/acre

needed for significance. Nine entries significantly outperformed the test mean. Eiger, a consistent performer over the last 5-years, was the top yielding variety. The other recent release tested was ND Pegasus, which yielded with Eiger and exhibited an attractive open canopy with high pod placement. It was encouraging to see both these new varieties continue to exceed the yield of Aries and Taurus from Nebraska with their susceptibility to lodging and white mold. Powderhorn, an older variety with shorter stature and earlier maturity ranked with Taurus at the bottom of the trial. Samurai (Otebo class) was included in the trial and ranked above Powderhorn but slightly below Aries. There remains room for future effort to combine the efficient partitioning of Powderhorn with the larger plant height of Eiger and ND Pegasus to further increase the yield potential of this class. Some G21-prefix breeding lines appear to exhibit issues with "fish-mouth" seed coat defect that has often been an issue in great northern class and will be eliminated from future testing. Seed size and canning quality will be considered prior to advancing lines to further testing.

Expt. 2107: Standard Pinto Bean Yield Trial

This 16-entry trial included MSU pinto lines (P-prefix) and standard commercial check varieties. The test ranged in yield from 27.5 to 39.4 cwt/acre with a mean yield of 33.1 cwt/acre. Variability was low (CV= 7.8%) resulting in an LSD value of 3.5 cwt/acre needed for significance. Only one entry, the new MSU variety Charro, significantly outperformed the test mean. Eldorado was slightly above the mean, while Lapaz matched the mean. New releases from USDA-Prosser, USDA Rattler (regular darkening) and USDA Diamondback (slow darkening), as well as ND Falcon from NDSU program were among the lower yielding entries this season. Falcon ranked similarly in 2020, but the two USDA varieties have performed better in past seasons. Efforts to introgress the slow darkening trait have often produced undesirable lateness or less upright architecture, although yield potential seems to be improving as in the case of P19103 that matched the yield of widely grown variety Lapaz. Newer slow dark families advancing through F4 and F5 nurseries looks to have better agronomic features and will be interesting to test in this trial next year. Few entries in this trial will likely advance to further testing given their lower yield compared to Charro and propensity towards rapidly darkening but canning quality will guide advancements.

Expt. 2108: Standard Small Red and Pink Bean Yield Trial

This 36-entry trial included small red and pink breeding lines from MSU (R-small red; S-pink prefix), in addition to standard commercial check varieties. The test ranged in yield from 26.0 to 40.2 cwt/acre with a mean yield of 34.0 cwt/acre. Variability was low (CV=6.7%) resulting in an LSD value of 2.7 cwt/acre for significance. Seven small red lines significantly out yielded the test mean. Four R20-prefix entries ranked in this group, along with R1760x family that has yielded well in previous years. Cayenne and Viper continue to be the dominant red checks in this trial, producing above average yields. Merlot was the lowest yielding variety. Pink beans were not among the top fourteen entries, but S18904 was the second highest yielding pink this season, significantly out-yielding Rosetta, and the top yielding entry overall in 2019 and 2020. It continues to show improved upright architecture (lodging=1.0), lack of stem breakage, and large attractive seed (42.1g) and has been proposed for release under the name 'Coral'. Canning trials will be conducted and only lines with quality equivalent or better than Cayenne will be advanced. Progress in pink and small red breeding programs continues to be limited by a lack of useful genetic variability. Efforts are underway to broaden the genetic base of the small red class using several

strategies that should improve potential of future material in this class.

Expt. 2109: F5 Navy and Black Bean Yield Trial

This large 134-entry trial was planted to evaluate the yield potential of F5 families and provide data to guide final single plant selections in the space planted breeding nurseries. Checks included current varieties, as well as top yielding breeding lines from 2020 trials. All populations in this trial suffered from delays in 2020 winter nursery associated with the covid pandemic. As a result, they failed to reach the desired F6 generation as scheduled for replicated yield testing, but sufficient seed was available this season to conduct a single rep augmented yield trial. The trial was among the first harvested, and yield data were used to target the highest yielding lines for further single plant selection in the F5 space planted nurseries. Those selections will be grown in the 2021-22 winter nursery, and enter a more typical three rep preliminary yield trial next season. Yields ranged from 19.1 to 41.1 cwt/acre and variation was well controlled (CV=9.0%). Several advanced breeding lines were among the highest yielding entries, which supported results of test 2102, but was disappointing in that no new material showed higher yield potential. However, 30 entries from both black and navy classes exceeded the yield of Zenith (34.6cwt), the highest yielding variety. Navy checks performed poorly, with Valiant (25.4 cwt) again ranking as the highest yielding navy check as in test 2104. Further selection of these materials will be made from lines advanced to Puerto Rico winter nursery and enter replicated yield testing in 2022.

Expt. 2110: F5 Great Northern, Pinto, Small Red and Pink Bean Yield Trial

This large 93-entry trial included great northern, pinto, small red, and pink breeding lines from MSU in addition to standard commercial check varieties. As described above for navies and blacks, this trial had similar objectives of refining the selection process of F5 material that fell behind schedule during the previous season. Yields ranged from 11.3 to 42.3 cwt/acre with a mean yield of 31.5 cwt/acre. Variability was well controlled (CV=6.8%) in this single rep augmented design trial. Six small red and pink lines yielded above the highest yielding check variety Charro, and 4-6 cwt above small red check Cayenne. Only three great northern breeding lines ranked above the newly released Eiger. Charro showed significant yield advantage again over USDA Diamondback, as observed in 2107. Further selection of these materials will be made from lines advanced to Puerto Rico winter nursery and enter replicated yield testing in 2022.

Expt. 2111 and 2112: MDP Panel

These trials were planted to provide a diverse range of plant habit, maturity, and lodging characteristics for evaluating potential of unmanned aerial systems (UAS) for high throughput phenotyping. The Mesoamerican Diversity Panel (MDP) consists of cultivars and elite breeding lines from the US and Canada developed over the past several decades and aims to represent the genetic diversity of bean germplasm found in North America. Yields ranged from 5.7 to 33.4 cwt/acre for small-seeded lines in test 2111 with a mean of 20.1 cwt/a and moderate CV=10.0%. Similarly test 2112 ranged from 9.9 to 31.9 cwt/acre with a mean of 21.5 cwt/a and moderate CV=11.3%. Numerous UAS flights were made throughout the season and analysis of imagery is ongoing.

Expt. 2113: Combined Midwest Regional Performance Nursery (MRPN) & Cooperative Dry Bean Nursery (CDBN) Yield Trial

The MRPN is conducted annually in cooperation with North Dakota (ND-prefix), Nebraska (NE-prefix) and Washington (GN, PK, PT, SR-prefix) to test new pinto, great northern, small red , and pink lines from all four programs and assess their potential in the different regions. The CDBN is a national trial and includes all classes, but only medium-sized entries were included in this trial this year. The 32-entry trial ranged in yield from 20.9 to 38.0 cwt/acre with a mean of 30.6 cwt/acre. Variability was low (CV=9.4%) resulting in a LSD value (3.9 cwt/acre) for significance. As a result, eight lines were significantly higher in yield than the test mean including pink S18904 under consideration for release as 'Coral' as the top yielding entry. Adams and Charro were the top yielding varieties (~34cwt/acre), followed by USDA Rattler (33cwt), Lapaz (32.5cwt), Merlot (30.9cwt), USDA Diamondback (28.8cwt), and Othello (26.4cwt). This cooperative trial continues to be a valuable opportunity to evaluate potential new lines from other breeding programs in the US prior to their release. Several lines from both WA and ND appeared to be better adapted to local conditions, including the first slow darkening pink tested from ND. In contrast, five of the NE entries showed less adaptation and clustered at the bottom of the trial. Canning quality will also be evaluated for all entries and shared with the other breeders to inform further decisions and aide in improving canning quality for the bean industry.

Expt. 2114: National Dry Bean Drought Nursery

This 24-entry trial was conducted to evaluate a series of breeding lines identified through shuttle breeding between University Nebraska and USDA-TARS station in Puerto Rico as possessing improved levels of drought stress. The trial was replicated by collaborators at various locations across the US and PR. Yields ranged from 11.5 to 39.7 cwt/acre with a mean of 24.8 cwt/acre. Variability was well controlled (CV=8.8%) and the LSD needed for significance was 3.0 cwt/acre. Seven lines significantly out yielded the test mean, including varieties Charro, Adams, Eiger for the second year. Pink bean S18904 (Coral), as well as pink, great northern, and pinto lines from WA rounded out this group. Checks Stampede, Marquis, and Merlot clustered around the mean, while Matterhorn ranked second from the bottom of the trial. Although this trial is planted to evaluate abiotic stress, primarily drought tolerance, favorable conditions throughout most of the growing season did not provide suitable conditions for that purpose. This trial still serves as an opportunity to screen breeding lines under severe drought conditions imposed by collaborators in more arid environments, but it also allows identification of those stress tolerant lines that possess high yield potential when grown under more favorable conditions. The ability to tolerate a wide range of atypical environmental conditions year to year may be important in developing resilient varieties that are adapted to increasing climate variability in Michigan.

Expt. 2115: Standard Kidney Bean Yield Trial

This 56-entry trial was conducted at Montcalm Research Farm (MRF) (on Comden 3 field with minimal history of beans) to compare the performance of standard and new light red kidney (LRK), dark red kidney (DRK), and white kidney (WK) varieties from MSU and CDBN under supplemental irrigation (13x, total 7.7"). In contrast to 2020, there was significant *Fusarium* Root Rot (FRR) disease pressure which delayed plant growth following heavy rain during last week of

June and early July (~7.8”). This disease pressure presented an opportunity to dig and evaluate root rot symptoms from the border rows of this trial. Canopy closure was delayed, and overall plant size reduced. Yields ranged from 16.8 to 38.5 cwt/acre with a mean of 28.4 cwt/acre. Variability was well controlled (CV=9.1%) resulting in a LSD value of 3.5 cwt/acre needed for significance. As a result of the wide range in yields, twenty-two entries significantly out-yielded the test mean, including breeding lines from all three kidney classes, and the variety Coho. Numerous newer breeding lines (K20-prefix), especially LRK, seemed to tolerate the FRR pressure which suggests progress is being made in breeding for improved levels of resistance. Coho was noted for FRR tolerance when it was released, and it is quite interesting that it is the only variety at the top of the trial, while all the other check varieties cluster below the mean. Likewise, Snowdon has not ever shown tolerance to root rots, and was the lowest yielding check, ranking second from last. K16924, under consideration for release as ‘Denali’, produced 26.5 cwt/acre under these conditions, although it remains as the highest yielding WK entry in the Michigan Dry Bean Performance trials this year, and on a three-year mean basis. In general, there is more work to be done in breeding for improved root rot resistance, but it was encouraging to see variability for resistance in this trial suggesting that continued breeding progress can be made. Canning trials will be conducted prior to advancing these lines for further testing.

Expt. 2116: Standard Yellow Bean Yield Trial

This 18-entry trial was conducted to evaluate yellow bean breeding lines and commercial varieties. Yields ranged from 7.6 to 25.8 cwt/acre with a mean of 20.6 cwt/acre. Variability was moderate (CV=11.1%) and the LSD needed for significance was 2.7 cwt/acre. Five entries significantly out-yielded the test mean including varieties Patron from OSU and SVS-0863 from Seminis. FRR appeared to limit yield potential in this trial, as the top yield was ~7cwt below 2020. As a result, Yellowstone produced 20.9 cwt/acre, while it has been among the better yielding entries in previous years. Seed size and bright yellow color will continue to be important selection criteria in this class. Canning trials will also be conducted. Efforts also need to be made in this class to access additional genetic diversity and incorporate anthracnose resistance as all yellow beans grown in the trial are completely susceptible.

Expt. 2117: NSI White Mold Yield Trial

This large 176-entry trial was funded by the National Sclerotinia Initiative (NSI) and conducted to evaluate white mold tolerance of all MSU navy, black, small red, and pink breeding lines as compared to commercial checks and selected germplasm previously identified as possessing confirmed white mold (WM) resistance QTL. A second objective was to genotype all entries and use this data to build a genomic prediction (GP) model as a proof of concept that could be used to predict white mold tolerance and other agronomic traits in future breeding lines. UAS was also deployed to collect data towards the objective of phenotyping WM development and rating resistance from aerial imagery. Yields ranged from 7.8 to 33.7 cwt/acre with a mean of 18.8 cwt/acre. Variation was higher in this trial (CV=14.9%) due to severe white mold infection that developed as a result of natural infection managed via high fertility, supplemental irrigation, and the use of susceptible spreader rows (Black Bear) to border all plots. As a result, an LSD of 3.8 cwt/acre was needed for significance. These conditions were ideal for the objectives of the trial, and WM was rated on a scale of 1-9 as with the National WM trial. SR9-5 was the highest yielding

entry (28.3cwt) with confirmed resistance QTL. Germplasm USPT-WM12 (24.3cwt) also performed well under disease pressure. Meanwhile G122, considered the highly resistant check for the National White Mold Trial produced 12.5 cwt. Bunsi, the moderately resistant check yielded 15.1 cwt, and Beryl, the susceptible check 8.2 cwt/acre. These results suggest some of the newer germplasm releases developed by USDA-Prosser program may serve as more appropriate resistant checks for white mold trials in the future, particularly in MI under direct harvest conditions. Analysis is ongoing to evaluate the data collected via UAS and genetic data for GP.

Expt. 2118: National White Mold Yield Trial

This 16-entry trial was conducted to evaluate a range of diverse dry bean varieties and breeding lines for reaction to white mold under natural field conditions. Entries included commercial navy and pinto bean cultivars, elite MSU lines, and new sources of white mold resistance entered as part of the National Sclerotinia Initiative (NSI) Nursery. Lines in the National trial were developed at MSU, USDA-WA, NDSU, and University of Nebraska (UNL). As with test 2117, entries were planted in two row plots with two rows of susceptible spreader variety Black Bear between plots and were direct harvested. Plots were fertilized with 120 lbs N/ acre to promote vegetative growth and supplemental overhead irrigation was applied to maintain adequate levels of moisture for favorable disease development at the critical flowering period. Overall disease development was excellent. White mold was rated on a per plot basis on a scale of 1 to 9 based on disease incidence and severity where 9 had 90+% incidence and high severity index. White mold ranged from 33.3 to 96.3% with a mean value of 64.6%. The susceptible check Beryl had the highest white mold rating. The test ranged in yield from 7.8 to 24.9 cwt/acre with a mean yield of 16.1 cwt/acre. Variability was low (CV=9.2%), with a LSD value of 2.1 cwt/acre needed for significance. The highest yield was approximately 50% compared to 2020 when the top yielding entry Charro produced 50.4cwt/acre. Seven lines significantly out-yielded the test mean and included new release Charro (19.4 cwt/a), as well as breeding lines from each of the breeding programs that entered the trial. SR9-5 was the second highest yielding line, similar to test 2117. Likewise, Beryl was the lowest yielding, while G122 ranked twelfth at 11.7 cwt. The new navy release ND Polar from NDSU ranked thirteenth at 9.6 cwt/acre. The severe WM infection and drastic yield reductions observed in this trial serve as a reminder of the continued effort needed towards further improvement of resistance levels. This trial will continue to be part of the breeding effort to improve tolerance to white mold in future varieties in 2022.

Expt. 2119: Standard Black Bean Yield Trial (Ruth)

This 42-entry trial included the same standard commercial black bean varieties and advanced breeding lines as test 2102, except for ND Twilight which was substituted for R99 non-nodulating check. The trial was planted alongside the Michigan Dry Bean Performance Trials location near Ruth, MI and managed by Scott Bales. The objective was to expand black bean testing to Huron county, which has a slightly cooler and more humid climate given proximity to Lake Huron. It is also the largest bean production county in Michigan. Yields ranged from 25.7 to 44.2 cwt/acre with a test mean of 33.8 cwt/acre. Variability was low in this test, (CV=8.6%) although the LSD was 4.9 cwt/acre due to the two-rep trial. Six newer B20- lines significantly out yielded the test mean. Both Zenith and Adams also produced excellent yields (~38cwt) and Zorro was slightly lower (34.6cwt). Other varieties were lower yielding including Nimbus (31.8cwt), Eclipse

(31.1cwt), Black Bear (29.9 cwt), ND Twilight (28.2cwt) and Black Beard (27.5cwt). These results confirm that MSU varieties selected in Tuscola County at SVREC are well adapted to eastern Huron field conditions and quite competitive with private varieties developed elsewhere. It was interesting that B20536 was the highest yielding entry both here and at SVREC test 2102, while B20599, B20591, and B20590 were also significantly above mean in both locations. The trial did experience a ~5" rain event mid-season, followed by more frequent rains that induced white mold infection. This location also allowed for useful observations on WM tolerance. All entries will be canned and evaluated to improve selection for canning quality which is greatly influenced by environmental conditions (GxE). It would be useful to continue this trial in 2022 season and explore the possibility of adding advanced navy lines as well.

Early Generation Breeding Material grown in Michigan in 2021

F3 through F5 lines
Navy and Black - 408 lines
Pinto - 70 lines
GN - 66 lines
Pinks and Reds –47 lines
Kidneys (DR, LR, White) - 44 lines
Yellow – 8 lines

F2 populations
Navy and Black -189 populations
Pinto - 51 populations
GN - 42 populations
Pinks and Reds - 52 populations
Kidneys (DR, LR, White) - 74 populations

F1 populations: 425 different crosses among ten contrasting seed types.

2021 DRY BEAN YIELD TRIALS

Experiment	Title	Planting Date	Location	Entries	Design	Reps	Harvest Method
2101	STANDARD BLACK BEAN YIELD TRIAL -N		SVREC	42	ALPHA LATTICE	4	DIRECT
2102	STANDARD BLACK BEAN YIELD TRIAL +N		SVREC	42	ALPHA LATTICE	4	DIRECT
2103	PRELIMINARY BLACK BEAN YIELD TRIAL		SVREC	32	ALPHA LATTICE	3	DIRECT
2104	STANDARD NAVY BEAN YIELD TRIAL		SVREC	36	ALPHA LATTICE	4	DIRECT
2105	PRELIMINARY NAVY BEAN YIELD TRIAL		SVREC	40	ALPHA LATTICE	3	DIRECT
2106	STANDARD GREAT NORTHERN BEAN YIELD TRIAL		SVREC	36	ALPHA LATTICE	4	DIRECT
2107	STANDARD PINTO BEAN YIELD TRIAL		SVREC	16	ALPHA LATTICE	3	DIRECT
2108	STANDARD RED AND PINK BEAN YIELD TRIAL		SVREC	36	ALPHA LATTICE	4	DIRECT
2109	F5 NAVY AND BLACK OBSERVATION TRIAL		SVREC	134	AUG DESIGN	1	DIRECT
2110	F5 GN, PINTO, RED AND PINK OBSERVATION TRIAL		SVREC	93	AUG DESIGN	1	DIRECT
2111	MDP YIELD TRIAL-SMALL SEED		SVREC	96	ALPHA LATTICE	2	DIRECT
2112	MDP YIELD TRIAL-MEDIUM SEED		SVREC	168	ALPHA LATTICE	2	DIRECT
2113	MRPN/CDBN YIELD TRIAL		SVREC	32	ALPHA LATTICE	3	DIRECT
2114	NATIONAL DRYBEAN DROUGHT YIELD TRIAL		SVREC	24	ALPHA LATTICE	3	DIRECT
2115	STANDARD KIDNEY BEAN YIELD TRIAL		MRF	56	ALPHA LATTICE	3	ROD PULLED
2116	STANDARD YELLOW BEAN YIELD TRIAL		MRF	18	ALPHA LATTICE	4	ROD PULLED
2117	NSI WHITE MOLD YIELD TRIAL		MRF	176	ALPHA LATTICE	3	DIRECT
2118	NATIONAL WHITE MOLD YIELD TRIAL		MRF	16	ALPHA LATTICE	3	DIRECT
2119	HURON BLACK BEAN YIELD TRIAL		HUR	42	ALPHA LATTICE	2	DIRECT

PROCEDURE: PLANTED IN 4 ROW PLOTS, 20 FEET LONG, 20 INCH ROW WIDTH, 4 SEEDS/FOOT, 15 FOOT SECTION OF CENTER 2 ROWS WAS HARVESTED AT MATURITY.

SVREC-FRANKENMUTH: FERTILIZER BROADCAST: 300# OF 21-10-10 + 6%S, 2%ZN,1%MN PRIOR TO PLANTING.
HERBICIDES APPLIED: 1 PT DUAL + 1 QT EPTAM + 1.5 PT PROWL APPLIED PPI.
16 OZ. BASAGRAN + 8 OZ. REFLEX + 4 OZ. RAPTOR APPLIED POST.
INSECTICIDE: 4 OZ. MUSTANG MAXX.

MRF-ENTRICAN: FERTILIZER BROADCAST: 200# OF 19-10-19 PRIOR TO PLANTING. 80# 46-0-0 SIDE DRESSED ON JULY 12.
HERBICIDES APPLIED: 1.0 QT DUAL + 1.25 QT EPTAM + 1.0 QT SONOLAN APPLIED PPI.
4 OZ. RAPTOR + 14 OZ. REFLEX + 16 OZ. BASAGRAN + 12 OZ. SELECT ON JULY 10.
INSECTICIDE: 4 OZ MUSTANG MAXX ON JULY 10.
FUNGICIDE: 8 OZ. PRIAXOR JULY 10 and 26.

EXPERIMENT 2101 STANDARD BLACK BEAN YIELD TRIAL (-N)									PLANTED: 6/2/21
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
B19309	B15414/B16504	1	33.0	19.7	44.0	84.0	1.0	43.5	5.0
B20597	B16506/B15430	20	32.5	23.1	44.0	83.0	1.0	42.0	4.5
B16504	Zenith//Alpena*/B09197	7	32.5	19.4	44.0	88.0	2.0	47.5	5.0
B19330	B16501/B15414	4	32.2	22.8	44.0	86.0	2.0	39.8	4.5
B20602	B16506/B16504	23	32.0	23.4	44.0	84.0	1.5	43.0	4.5
B20591	B16505/B16504	19	31.9	20.7	44.0	85.0	2.0	46.3	4.5
B20536	B15430/B16504	30	31.9	20.3	44.0	88.0	1.0	51.0	6.0
B18504	Zenith//Alpena*/B09197, **ADAMS**	2	31.9	19.3	44.0	87.0	2.0	43.8	5.0
B20599	B16506/B15430	18	31.4	18.8	44.0	87.0	1.5	48.5	4.0
B20590	B16505/B16504	34	31.3	19.4	44.0	89.0	1.5	47.8	5.0
B20542	B16501/B15430	29	31.1	20.2	44.0	83.0	1.0	43.0	4.0
B19344	B16506/B16507	3	31.0	21.4	44.0	87.0	2.0	42.5	5.5
B20617	B17106/N14218	26	31.0	18.8	44.0	85.0	1.0	40.5	4.5
B20527	B14302/B15430	31	30.8	18.5	44.0	85.0	2.0	40.5	5.5
B20549	B16501/B16504	22	30.7	19.6	44.0	82.0	1.0	43.5	4.0
B20616	B17106/B17259	41	29.9	19.0	44.0	84.0	1.0	41.8	5.0
B20532	B15430/B16504	24	29.9	19.0	44.0	85.0	1.5	43.3	6.0
B10244	B04644/ZORRO, **ZENITH**	5	29.5	19.9	44.0	87.0	1.0	44.8	5.0
B20579	B16504/B17259	40	29.0	21.9	44.0	84.0	1.5	38.8	4.5
B20642	B17730/B16504	25	28.7	18.8	44.0	89.0	1.0	51.3	4.0
B20547	B16501/B16504	21	28.6	20.4	44.0	87.0	1.5	42.0	5.0
B19345	B16506/B16507	6	28.6	19.2	43.0	84.0	1.0	42.0	4.5
B20538	B15430/B16504	36	28.4	19.9	44.0	86.0	1.0	46.3	5.5
B19339	B16507/B15453	11	28.2	21.0	44.0	87.0	1.5	45.5	5.0
B20621	B17106/N14218	35	28.2	18.5	44.0	84.0	1.0	41.5	4.5
B20639	B17730/B15430	37	28.0	19.4	44.0	86.0	1.0	47.8	5.0
B19332	B16501/B15464	15	27.6	20.0	44.0	88.0	2.0	42.3	5.0
B20623	B17523/B16504	38	27.3	18.3	44.0	88.0	1.5	41.3	4.0
B20620	B17106/N14218	27	27.0	16.5	44.0	85.0	1.5	45.8	4.5
B19340	B16507/B15453	9	26.9	22.2	45.0	88.0	1.5	46.3	4.5

EXPERIMENT 2101 STANDARD BLACK BEAN YIELD TRIAL (-N)								PLANTED: 6/2/21	
NAME	**PEDIGREE**	**ENTRY**	**YIELD CWT /ACRE**	**100 SEED WT. (g)**	**DAYS TO FLOWER**	**DAYS TO MATURITY**	**LODGING (1-5)**	**HEIGHT (cm)**	**DES. SCORE**
B19341	B16507/B16501	13	26.8	20.0	44.0	85.0	2.0	40.8	4.0
B20627	B17540/N14218	39	25.9	18.2	44.0	85.0	1.0	42.3	4.5
B04554	B00103*/X00822, **ZORRO**	10	25.8	19.1	44.0	88.0	2.0	46.0	4.0
B20629	B17692/B16504	28	25.5	17.2	44.0	87.0	2.0	49.5	3.5
B18236	B14303/B12724	14	25.5	19.8	44.0	88.0	2.0	41.3	4.0
I17501	Jaguar/BL05222, **BLACK BEAR**	8	25.3	18.7	44.0	90.0	3.0	42.0	3.0
I03390	ND9902621-2, **ECLIPSE**	12	25.2	19.9	44.0	86.0	2.5	42.8	3.0
B20632	B17692/B16504	33	24.9	18.7	44.0	85.0	1.0	42.8	3.0
I21901	BL14500, **NIMBUS**	42	24.2	19.7	44.0	90.0	2.5	47.3	3.5
B20582	B16504/B17523	32	23.8	17.6	44.0	85.0	1.0	44.5	4.5
I19703	BL14506, **BLACK BEARD**	16	22.2	19.8	44.0	90.0	3.0	45.3	3.0
I07112	**R99 NO NOD**	17	1.5	16.1	44.0	95.0	1.0	30.8	1.0
MEAN (42)			28.0	19.6	44.0	86.2	1.5	43.8	4.4
LSD (.05)			3.0	0.9	0.6	2.7	0.6	4.7	0.8
CV%			9.1	3.8	1.2	1.9	24.6	9.1	11.0

EXPERIMENT 2102 STANDARD BLACK BEAN YIELD TRIAL (+N)								PLANTED: 6/2/21	
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
B20536	B15430/B16504	30	39.2	21.8	44.0	85.0	2.0	50.8	6.0
B20599	B16506/B15430	18	37.7	20.8	44.0	87.0	2.5	51.5	5.0
B16504	Zenith//Alpena*/B09197	7	37.7	20.4	44.0	89.0	2.0	45.5	4.5
B20591	B16505/B16504	19	36.9	21.6	44.0	86.0	2.0	50.0	5.0
B18504	Zenith//Alpena*/B09197, **ADAMS**	2	36.1	20.5	44.0	87.0	2.0	47.5	4.5
B20590	B16505/B16504	34	35.7	20.1	44.0	88.0	1.5	53.5	5.0
B19309	B15414/B16504	1	35.6	20.1	44.0	83.0	2.0	48.0	5.0
B19344	B16506/B16507	3	35.5	22.2	44.0	83.0	1.5	50.8	5.0
B20597	B16506/B15430	20	35.4	23.5	44.0	82.0	1.0	45.3	5.5
B20538	B15430/B16504	36	34.8	21.7	44.0	85.0	1.5	49.8	5.5
B20527	B14302/B15430	31	34.6	19.9	44.0	83.0	2.5	43.8	5.0
B20549	B16501/B16504	22	34.4	23.7	44.0	83.0	2.0	50.3	4.5
B20639	B17730/B15430	37	34.1	19.6	45.0	83.0	1.0	52.3	5.5
B20602	B16506/B16504	23	34.0	24.8	44.0	83.0	1.0	42.8	4.5
B20532	B15430/B16504	24	34.0	20.3	44.0	85.0	2.0	48.0	6.0
B20617	B17106/N14218	26	33.5	20.3	44.0	85.0	1.0	46.0	4.0
B19332	B16501/B15464	15	33.4	19.7	44.0	87.0	2.0	49.5	5.0
B19340	B16507/B15453	9	33.0	22.8	45.0	87.0	2.0	52.5	5.0
B10244	B04644/ZORRO, **ZENITH**	5	32.9	20.2	44.0	83.0	1.5	47.0	5.0
B20542	B16501/B15430	29	32.7	20.9	44.0	83.0	1.0	43.0	4.0
B20616	B17106/B17259	41	32.7	19.9	44.0	86.0	1.0	46.3	5.0
B20547	B16501/B16504	21	32.7	20.7	44.0	85.0	1.0	49.8	4.0
B19330	B16501/B15414	4	32.6	22.7	44.0	86.0	2.5	43.3	3.5
B19341	B16507/B16501	13	32.1	21.0	44.0	87.0	1.0	44.5	4.5
B19345	B16506/B16507	6	32.0	20.8	44.0	82.0	1.0	42.8	4.0
B19339	B16507/B15453	11	31.8	22.1	44.0	87.0	1.5	49.5	4.0
B20579	B16504/B17259	40	31.8	22.8	44.0	86.0	1.5	42.8	4.0
B20621	B17106/N14218	35	31.6	18.1	44.0	84.0	1.5	48.3	5.0
B20582	B16504/B17523	32	31.2	18.8	44.0	86.0	1.5	49.5	5.0
I21901	BL14500, **NIMBUS**	42	31.1	21.8	44.0	89.0	2.5	48.5	3.0

EXPERIMENT 2102 STANDARD BLACK BEAN YIELD TRIAL (+N)								PLANTED: 6/2/21	
NAME	**PEDIGREE**	**ENTRY**	**YIELD CWT /ACRE**	**100 SEED WT. (g)**	**DAYS TO FLOWER**	**DAYS TO MATURITY**	**LODGING (1-5)**	**HEIGHT (cm)**	**DES. SCORE**
B20620	B17106/N14218	27	31.1	18.2	44.0	86.0	1.5	52.3	5.0
B20642	B17730/B16504	25	31.0	20.2	44.0	84.0	1.0	55.3	4.0
B20627	B17540/N14218	39	30.8	19.3	44.0	84.0	1.5	46.3	5.0
B20623	B17523/B16504	38	30.6	18.5	44.0	86.0	1.0	44.8	4.0
I03390	ND9902621-2, **ECLIPSE**	12	30.5	20.1	44.0	86.0	2.0	40.0	3.5
B04554	B00103*/X00822, **ZORRO**	10	30.2	20.4	44.0	87.0	2.5	43.3	4.0
B20629	B17692/B16504	28	28.8	18.7	44.0	88.0	2.0	49.8	4.5
B18236	B14303/B12724	14	28.5	21.0	44.0	85.0	2.0	42.5	4.5
B20632	B17692/B16504	33	28.5	19.2	44.0	84.0	1.0	39.3	3.5
I19703	BL14506, **BLACK BEARD**	16	28.3	21.2	44.0	90.0	3.0	48.8	3.0
I17501	Jaguar/BL05222, **BLACK BEAR**	8	27.4	19.1	44.0	90.0	3.0	42.3	3.0
I07112	**R99 NO NOD**	17	3.9	17.6	46.0	96.0	1.5	30.8	1.0
MEAN (42)			32.1	20.6	44.1	85.5	1.7	46.8	4.4
LSD (.05)			3.6	0.9	0.4	2.6	0.8	5.3	0.7
CV%			9.5	3.6	0.7	1.8	29.1	9.6	8.9

EXPERIMENT 2103 PRELIMINARY BLACK BEAN YIELD TRIAL								PLANTED: 6/2/21	
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
B21710	B16501/B15430	10	37.7	19.5	44.0	83.0	1.5	50.7	5.0
B21708	B15430/B16504	8	37.2	21.0	44.0	82.0	2.0	46.3	4.5
B21714	B16501/B16504	14	35.9	20.5	45.0	83.0	1.0	49.0	4.5
B21712	B16501/B16504	12	35.8	21.4	44.0	85.0	2.0	41.7	4.0
B21724	B17996/B17540	24	35.8	20.5	44.0	83.0	2.0	45.0	5.0
B21713	B16501/B16504	13	35.5	21.9	44.0	88.0	2.0	45.0	4.0
B21717	B16504/B17106	17	35.4	19.9	44.0	87.0	1.5	47.7	4.0
B18504	Zenith//Alpena*/B09197, **ADAMS**	25	35.3	20.2	44.0	87.0	2.0	45.7	4.5
B21707	B15430/B16504	7	35.2	20.5	44.0	83.0	1.0	50.0	5.5
B21701	N14218/B16504	1	35.0	18.1	45.0	86.0	2.0	52.0	4.0
B21706	B15430/B16504	6	35.0	21.1	45.0	87.0	2.0	43.0	4.0
B19309	B15414/B16504	30	34.9	20.3	44.0	83.0	1.0	51.7	5.0
B21715	B16501/B16504	15	34.8	19.7	45.0	86.0	2.0	47.0	4.5
B19330	B16501/B15414	32	34.6	22.6	44.0	83.0	2.0	50.7	4.5
B21711	B16501/B15430	11	34.6	21.4	44.0	82.0	1.0	47.3	6.0
B21704	N17504/B15430	4	34.5	21.1	44.0	83.0	1.0	46.0	5.0
B10244	B04644/ZORRO, **ZENITH**	26	34.4	20.2	44.0	87.0	2.0	49.3	4.5
B21720	B16505/B16504	20	34.4	19.4	44.0	87.0	2.0	47.0	5.0
B21705	B14302/B15430	5	34.4	20.8	44.0	87.0	2.0	51.0	4.5
B21718	B16504/B17523	18	34.3	18.2	44.0	86.0	1.0	48.7	4.5
B21719	B16504/N17504	19	33.6	19.8	44.0	83.0	2.0	48.0	5.0
B21716	B16504/B17106	16	33.5	20.6	44.0	82.0	2.0	45.3	5.0
B19344	B16506/B16507	31	33.4	22.0	44.0	85.0	2.0	48.7	4.5
B21722	B17692/B16504	22	31.9	20.5	44.0	85.0	2.0	44.0	4.0
B21703	N16405/B15430	3	31.8	17.4	44.0	83.0	2.0	47.7	5.0
B04554	B00103*/X00822, **ZORRO**	27	31.6	20.4	44.0	88.0	2.0	46.3	4.0
B21721	B17523/B16504	21	30.7	18.1	44.0	85.0	1.0	45.7	3.5
B21702	N14229/B16504	2	30.6	23.8	44.0	83.0	1.5	52.3	4.5
B21709	B15430/N14229	9	29.7	18.4	45.0	84.0	1.0	51.7	5.0
B21723	B17730/B16504	23	29.5	18.5	44.0	88.0	1.0	53.7	5.0
I21901	BL14500, **NIMBUS**	29	29.0	21.9	44.0	88.0	2.0	45.3	3.5
I17501	Jaguar/BL05222, **BLACK BEAR**	28	27.8	19.7	44.0	90.0	2.5	47.0	3.0
MEAN (32)			33.7	20.3	44.2	84.8	1.7	47.8	4.5
LSD (.05)			3.0	0.8	0.7	2.0	0.6	6.0	0.8
CV%			6.5	3.0	1.2	1.4	21.3	9.2	10.0

EXPERIMENT 2104 STANDARD NAVY BEAN YIELD TRIAL									PLANTED: 6/2/21
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
N20401	B16505/N17504	28	32.9	17.9	44.0	87.0	1.5	46.5	5.0
N20388	B15430/N14229	22	32.6	20.2	44.0	90.0	1.5	50.0	5.0
N20395	B16504/N17504	25	31.8	18.8	44.0	85.0	1.0	43.5	5.0
N19277	N14229/N14218	5	31.6	16.7	45.0	87.0	2.0	46.0	4.5
N20404	B16505/N17504	23	31.2	20.1	43.0	90.0	2.0	53.0	4.5
N18105	N13131/N14201	9	31.1	19.9	45.0	88.0	1.0	53.0	4.5
N19246	N15331/N16405	2	30.8	19.6	44.0	87.0	2.0	43.0	4.5
N19284	G14505/X16708	15	30.6	21.6	45.0	90.0	1.5	54.5	4.5
N19290	N13142/B14302	6	29.6	21.0	45.0	89.0	2.5	50.5	4.0
N19253	N15335/N14243	17	29.5	17.0	45.0	89.0	1.0	48.5	5.0
N19252	N15335/N14243	16	29.1	19.5	42.0	84.0	1.5	44.5	4.5
N19243	N15331/N16405	4	28.9	19.2	44.0	88.0	2.5	45.0	4.5
N20317	N14218/N17504	36	28.9	18.6	44.0	86.0	1.0	41.5	4.5
N19223	N14230/N16405	14	28.7	16.7	45.0	89.0	1.0	49.0	5.0
N18122	N15334/N15335	10	28.4	21.0	45.0	90.0	1.5	64.5	5.5
N20384	N14229/N17506	35	28.3	17.6	45.0	86.0	1.0	48.0	4.5
N20343	N15337/N16405	31	28.2	16.7	45.0	84.0	1.5	43.5	5.0
N18130	N15341/N14238	13	27.7	19.0	44.0	88.0	2.0	45.0	4.5
N18103	N13120/PR00806-81	11	27.5	21.3	45.0	89.0	2.0	42.5	4.0
N19239	N15331/N16404	3	27.4	18.1	45.0	88.0	2.0	40.0	4.0
N19285	G14505/X16708	7	26.9	22.2	43.0	90.0	3.0	47.5	4.0
N20336	N15306/N14218	26	26.9	16.4	45.0	87.0	2.5	46.5	5.0
N20405	B17523/B16504	30	26.7	18.8	44.0	89.0	1.5	45.5	4.5
N19269	B15453/N14243	12	26.6	18.9	44.0	89.0	2.0	42.0	5.0
I20815	**VALIANT**	8	26.5	22.2	40.0	90.0	2.5	40.5	4.0
N20335	N14229/G14503	27	26.4	16.9	45.0	87.0	1.5	47.0	5.0
N20341	N15337/N16405	34	26.3	19.1	45.0	87.0	1.5	47.5	4.0
N20346	N16405/N15337	33	26.1	18.0	45.0	88.0	2.5	49.5	4.0
N20352	N16405/G16301	24	25.8	24.6	41.0	85.0	3.0	42.5	4.0
N11283	MEDALIST/N08003, **ALPENA**	19	25.4	18.0	45.0	87.0	2.5	40.5	4.5

EXPERIMENT 2104 STANDARD NAVY BEAN YIELD TRIAL									PLANTED: 6/2/21
NAME	**PEDIGREE**	**ENTRY**	**YIELD CWT /ACRE**	**100 SEED WT. (g)**	**DAYS TO FLOWER**	**DAYS TO MATURITY**	**LODGING (1-5)**	**HEIGHT (cm)**	**DES. SCORE**
I21920	**HMS BOUNTY**	21	25.4	18.9	43.0	91.0	2.0	42.5	4.0
N19226	N14243/N15326	1	25.3	17.1	46.0	88.0	2.5	49.5	5.0
N20391	B16504/N14218	29	25.0	16.5	45.0	92.0	1.5	53.5	4.0
I11264	COOP 03019, **MERLIN**	18	24.3	19.9	44.0	91.0	2.0	45.0	4.0
N20376	N17506/N16405	32	24.2	17.2	45.0	84.0	2.5	43.5	4.0
I08958	Mayflower/Avanti, **MEDALIST**	20	20.1	19.4	42.0	91.0	2.0	40.5	4.0
MEAN (36)			27.9	19.0	43.9	87.8	1.9	46.5	4.5
LSD (.05)			3.2	1.0	1.2	3.1	0.9	7.0	0.9
CV%			6.8	3.1	1.7	2.1	27.9	8.9	12.2

EXPERIMENT 2105 PRELIMINARY NAVY BEAN YIELD TRIAL								PLANTED: 6/2/21	
NAME	**PEDIGREE**	**ENTRY**	**YIELD CWT /ACRE**	**100 SEED WT. (g)**	**DAYS TO FLOWER**	**DAYS TO MATURITY**	**LODGING (1-5)**	**HEIGHT (cm)**	**DES. SCORE**
N21525	N17506/N14229	25	37.5	18.2	44.0	84.0	2.0	50.0	4.5
N21520	N17504/N14229	20	36.8	16.6	44.0	84.0	1.5	45.7	4.0
N21508	N14229/B14302	8	35.8	17.2	44.0	86.0	2.0	43.7	5.0
N21501	N14218/N15306	1	35.3	16.7	45.0	85.0	2.0	42.0	4.0
N21510	N15306/N14229	10	34.9	16.8	44.0	86.0	2.5	47.3	4.5
N21530	N14229/N17506	30	34.6	16.2	45.0	88.0	2.5	51.0	4.5
N21511	N15306/N15337	11	34.0	19.1	45.0	86.0	2.5	50.0	4.0
N21515	N15306/N17504	15	33.4	16.6	45.0	87.0	2.0	49.3	4.5
N21529	N17506/B15430	29	33.2	17.6	44.0	88.0	2.0	48.3	4.0
N21522	N17504/B15430	22	32.9	17.2	45.0	84.0	2.0	43.3	4.5
N21502	N14218/N15306	2	32.7	15.9	45.0	86.0	2.5	43.7	4.0
N21526	N17506/N14229	26	32.5	16.9	45.0	87.0	2.0	43.7	4.5
N21506	N14229/N17504	6	32.5	15.8	45.0	85.0	2.0	42.7	4.0
N21514	N15306/N17504	14	32.4	17.5	45.0	85.0	1.5	45.0	4.0
N21532	B16504/B11519	32	32.4	17.3	45.0	87.0	1.0	41.0	4.5
N21523	N17504/B15430	23	32.3	18.4	44.0	88.0	3.0	44.7	4.0
N21524	N17504/B17106	24	32.0	17.9	45.0	85.0	2.0	45.3	4.5
N21528	N17506/B15430	28	31.9	18.8	45.0	87.0	1.5	45.0	4.0
N21507	N14229/B14302	7	31.9	18.5	45.0	86.0	2.0	51.3	5.0
N21513	N15306/N16405	13	31.6	17.6	45.0	86.0	2.0	40.3	4.5
N21505	N14229/N17504	5	31.3	15.3	44.0	84.0	1.5	46.0	4.5
N21503	N14218/N17504	3	31.3	17.0	44.0	85.0	2.0	45.7	4.0
N21534	G16339/N17506	34	31.0	22.9	45.0	85.0	1.5	46.7	4.0
N21516	N16405/N15337	16	30.5	16.9	44.0	87.0	2.0	49.0	4.0
N21518	N16405/G17923	18	30.5	17.9	44.0	88.0	1.5	55.0	5.0
N21517	N16405/G17923	17	30.5	21.5	44.0	88.0	1.5	50.7	4.0
N21531	B15430/N14229	31	30.2	16.9	44.0	84.0	1.0	45.3	5.0
N21504	N14218/N17504	4	30.2	16.5	44.0	83.0	1.0	40.0	4.0
N21509	N14229/B16504	9	29.8	17.3	44.0	91.0	1.5	53.0	4.0
I11264	COOP 03019, **MERLIN**	36	29.6	18.3	44.0	91.0	2.5	42.7	3.5

EXPERIMENT 2105 PRELIMINARY NAVY BEAN YIELD TRIAL								PLANTED: 6/2/21	
NAME	**PEDIGREE**	**ENTRY**	**YIELD CWT /ACRE**	**100 SEED WT. (g)**	**DAYS TO FLOWER**	**DAYS TO MATURITY**	**LODGING (1-5)**	**HEIGHT (cm)**	**DES. SCORE**
N21512	N15306/N16405	12	29.5	16.5	45.0	85.0	1.5	45.7	5.0
N21533	G16339/N17506	33	29.2	22.0	44.0	87.0	3.0	44.3	4.0
N11283	MEDALIST/N08003, **ALPENA**	37	29.0	18.3	45.0	89.0	3.0	45.0	3.5
I20816	ND132162, **ND POLAR**	39	28.8	18.0	45.0	89.0	2.5	47.3	4.0
N21535	G16339/N17506	35	28.7	18.1	45.0	87.0	2.5	46.0	4.0
I21920	**HMS BOUNTY**	40	28.7	18.5	44.0	90.0	1.0	40.0	3.0
N21521	N17504/N14229	21	28.1	17.5	45.0	86.0	1.0	48.0	5.5
N21519	N17504/N14229	19	27.6	16.0	45.0	86.0	1.0	40.3	4.0
N21527	N17506/N16405	27	25.1	17.9	45.0	84.0	3.0	48.0	4.0
I20815	**VALIANT**	38	23.2	21.0	39.0	91.0	2.0	35.7	3.0
MEAN (40)			31.3	17.8	44.4	86.5	1.9	45.7	4.2
LSD (.05)			3.8	0.9	0.8	2.3	1.1	6.4	0.7
CV%			9.0	3.6	1.3	2.0	33.1	10.3	10.0

EXPERIMENT 2106 STANDARD GREAT NORTHERN BEAN YIELD TRIAL								PLANTED: 6/2/21	
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
G19609	G16346/G16318	19	36.3	43.4	42.0	89.0	2.5	41.5	4.0
G17410	G13467/G13479	33	36.1	37.7	41.0	90.0	2.0	42.8	4.0
G16345	G12508/G13455	35	36.1	32.0	41.0	85.0	2.5	42.8	3.5
G21816	G17410/G14510	28	36.0	36.8	40.0	90.0	2.5	42.5	3.5
G19613	G16351/P16902	3	35.9	42.5	43.0	90.0	2.5	47.3	4.0
G21811	G16306/G17411	23	35.9	38.3	39.0	87.0	1.5	50.0	4.5
G19624	G16339/G16318	10	35.8	34.7	40.0	85.0	2.5	37.5	3.5
G18502	G13444/G14506	4	35.7	34.5	42.0	89.0	3.0	39.8	3.5
G16351	Eldorado/G13467, **EIGER**	2	35.6	35.3	40.0	87.0	2.0	44.0	4.5
I15652	ND121630, **ND PEGASUS**	8	34.6	39.2	41.0	86.0	2.5	40.3	4.0
G19623	G16339/G16318	9	34.2	36.6	41.0	84.0	2.5	40.0	4.0
G19611	G16346/G16318	1	34.1	39.6	42.0	91.0	3.0	46.8	3.5
G21820	P16905/G16341	32	32.8	36.8	41.0	88.0	3.0	39.3	3.5
G21812	G16309/G16306	24	32.8	32.3	42.0	86.0	3.0	43.8	3.5
G19607	G16346/G16318	7	32.6	45.6	41.0	92.0	2.0	51.3	4.0
G21815	G16341/P14814	27	32.3	35.0	43.0	89.0	3.5	40.0	3.0
G18512	G14525/P14815	6	32.1	35.5	42.0	84.0	3.0	38.5	3.5
G21809	G16306/G17411	21	31.8	41.1	40.0	87.0	2.5	44.8	4.0
G21817	G17411/P16901	29	31.3	34.4	41.0	86.0	2.5	47.3	4.0
I19717	GN16-7-3	12	30.6	38.1	40.0	88.0	2.5	43.3	4.0
G18506	G14525/G13444	31	30.4	41.3	40.0	86.0	3.5	33.5	3.0
G21801	G14510/G17410	13	30.3	30.9	41.0	93.0	2.5	42.3	3.0
G21810	G16306/G17411	22	30.2	38.1	40.0	91.0	2.5	43.8	3.5
G21808	G16306/G17411	20	29.9	42.1	39.0	85.0	1.5	39.5	4.0
G21813	G16309/G16306	25	29.8	36.7	43.0	87.0	1.5	44.0	4.0
I18601	Matterhorn/NE94-75, **ARIES**	36	29.4	37.9	40.0	83.0	4.0	32.3	3.0
G21802	G14510/G17410	14	28.9	33.1	42.0	85.0	2.5	37.3	3.5
G21804	G16301/G16309	16	28.6	35.0	40.0	84.0	3.5	37.0	3.0
G21803	G14510/G17410	15	28.0	36.0	41.0	87.0	3.0	36.0	3.5
G21806	G16301/G16309	18	27.1	35.4	40.0	83.0	4.0	32.8	2.5

EXPERIMENT 2106 STANDARD GREAT NORTHERN BEAN YIELD TRIAL								PLANTED: 6/2/21	
NAME	**PEDIGREE**	**ENTRY**	**YIELD CWT /ACRE**	**100 SEED WT. (g)**	**DAYS TO FLOWER**	**DAYS TO MATURITY**	**LODGING (1-5)**	**HEIGHT (cm)**	**DES. SCORE**
G12901	G07321/Fuji, **SAMURAI**	34	26.8	26.9	42.0	88.0	2.5	41.0	3.0
G21814	G16309/G16306	26	26.7	31.3	43.0	87.0	2.0	43.5	3.5
G21805	G16301/G16309	17	24.9	33.4	42.0	84.0	2.5	40.5	3.5
G08254	G04514/Matterhorn, **POWDERHORN**	5	22.6	35.8	39.0	83.0	4.0	34.8	2.5
I17509	**TAURUS**	11	22.2	40.6	40.0	87.0	3.0	36.5	3.0
G21818	P16901/G16341	30	21.9	40.7	40.0	90.0	2.5	42.0	3.5
MEAN (36)			31.1	36.8	40.7	87.0	2.7	41.1	3.6
LSD (.05)			3.6	2.0	2.1	2.7	0.9	6.4	1.1
CV%			9.9	3.3	3.0	2.7	20.8	13.3	18.1

EXPERIMENT 2107 STANDARD PINTO BEAN YIELD TRIAL									PLANTED: 6/2/21
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
P16901	Eldorado/P11519, **CHARRO**	7	39.4	38.4	44.0	86.0	2.0	41.3	5.0
P19713	P16911/P16901	2	35.0	37.6	44.0	84.0	2.0	50.3	5.0
P19707	P16911/X16801	5	35.0	40.6	42.0	87.0	2.0	55.7	5.0
P21901	P16901/G16306	16	34.5	42.7	41.0	83.0	2.0	43.7	5.0
I20804	PT16-12-1	15	34.0	38.1	42.0	85.0	3.0	45.0	4.5
P07863	AN-37/P02630, **ELDORADO**	10	33.8	39.3	40.0	94.0	3.0	35.0	3.0
P18608	P11522/LONG'S PEAK	8	33.7	34.0	44.0	87.0	2.0	46.0	5.0
P19103	Eldorado*/Palomino//G13444 (SDP)	3	33.6	34.3	41.0	97.0	3.5	45.3	2.5
P19703	I16706/P16901	11	33.2	36.7	44.0	87.0	3.0	37.0	4.5
I07113	PNE-6-94-75/Kodiak, **LAPAZ**	4	33.1	37.3	43.0	87.0	3.0	42.0	3.5
P16902	P11519/P12610	1	32.9	40.1	39.0	87.0	2.5	46.7	4.0
P19708	P16913/P16901	9	32.2	42.7	42.0	82.0	1.0	43.7	6.0
I20801	PT11-13-31, **USDA RATTLER**	13	31.4	41.4	41.0	85.0	2.0	45.7	4.5
I16705	ND121448, **ND FALCON**	14	30.6	37.1	44.0	87.0	2.5	49.0	4.0
P18603	P14815/G14525	12	30.2	40.0	43.0	88.0	3.0	38.7	3.0
I18623	PT16-9, **USDA DIAMONDBACK**	6	27.5	40.0	42.0	86.0	2.0	47.0	4.5
MEAN (16)			33.1	38.8	42.0	86.8	2.4	44.5	4.3
LSD (.05)			3.5	1.7	1.3	2.2	0.5	6.8	0.8
CV%			7.6	2.4	1.7	1.5	11.8	11.0	10.2

EXPERIMENT 2108 STANDARD RED AND PINK BEAN YIELD TRIAL								PLANTED: 6/2/21	
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
R20669	I13401/R17603	23	40.2	33.6	46.0	90.0	3.0	42.0	4.0
R17605	R12859/R12844	4	37.8	34.6	45.0	87.0	2.0	50.0	4.5
R20653	I13401/R17603	26	37.6	32.9	46.0	88.0	2.5	41.0	4.5
R17603	R12859/R12844	12	37.1	31.2	45.0	88.0	3.0	40.8	3.5
R17604	R12859/R12844	7	37.0	30.1	46.0	87.0	3.0	39.5	4.0
R20684	I13401/R17605	29	36.8	32.1	45.0	87.0	2.5	38.8	4.0
R20652	I13401/R12844	17	36.8	31.2	45.0	89.0	2.0	41.8	4.5
R20683	I13401/R17605	24	36.6	32.3	45.0	89.0	3.0	37.8	4.0
R12844	SR9-5/R09508, **CAYENNE**	9	36.6	34.6	44.0	88.0	3.0	40.5	4.0
R20604	R12844/I13401	25	35.9	32.6	46.0	90.0	2.5	39.8	3.5
R18402	R12859/R12844	10	35.5	35.5	45.0	89.0	3.5	41.3	3.5
R20659	I13401/R17603	19	35.2	32.5	46.0	90.0	2.0	46.5	5.0
I13401	SR99238/Merlot, **VIPER**	8	35.2	28.1	45.0	88.0	1.5	43.5	4.0
R20639	R17605/R16503	18	34.9	32.5	45.0	91.0	2.5	45.8	4.5
S20405	S17702/R17604	36	34.7	34.7	46.0	87.0	2.5	39.8	3.5
R20637	R17605/R16503	20	34.7	31.4	45.0	90.0	2.5	43.8	4.5
R20614	R17604/I13401	35	34.6	33.0	46.0	88.0	1.5	41.8	5.0
R17602	R12845/R12859	3	34.4	37.7	45.0	88.0	3.0	42.5	3.5
R20624	R17605/R16503	28	34.1	32.2	45.0	88.0	2.0	50.5	4.5
R20632	R17605/R16503	32	33.8	32.6	46.0	88.0	3.0	44.3	4.5
R20667	I13401/R17603	16	33.6	32.6	44.0	87.0	2.5	43.3	4.5
R20633	R17605/R16503	21	33.4	34.4	46.0	88.0	2.0	42.3	5.0
R20627	R17605/R16503	15	33.3	32.8	45.0	89.0	2.5	44.8	4.5
S18904	S14706/R13752, **CORAL**	1	33.2	42.1	45.0	86.0	1.0	43.3	4.5
R20642	I13401/R12844	27	33.0	32.0	46.0	89.0	2.0	49.5	4.0
R20629	R17605/R16503	33	32.9	32.4	44.0	85.0	2.0	45.0	4.5
R20625	R17605/R16503	22	32.7	30.5	45.0	87.0	2.0	48.8	5.0
S18907	S14706/R13752	5	32.6	38.8	45.0	84.0	2.0	42.8	4.0
R20635	R17605/R16503	30	32.6	31.4	45.0	87.0	2.0	43.8	4.5
R20636	R17605/R16503	34	32.5	34.5	46.0	89.0	3.0	38.3	3.5

EXPERIMENT 2108 STANDARD RED AND PINK BEAN YIELD TRIAL									PLANTED: 6/2/21
NAME	**PEDIGREE**	**ENTRY**	**YIELD CWT /ACRE**	**100 SEED WT. (g)**	**DAYS TO FLOWER**	**DAYS TO MATURITY**	**LODGING (1-5)**	**HEIGHT (cm)**	**DES. SCORE**
R20612	R17603/I17551	31	30.7	35.3	46.0	90.0	3.0	37.5	3.0
S19307	X16804/S16804	2	30.1	35.4	44.0	85.0	1.5	41.3	4.0
S08418	S02754/S04503, **ROSETTA**	6	30.0	38.1	45.0	85.0	1.5	43.5	4.0
R19502	R16519/R16518	11	29.9	34.0	45.0	85.0	1.5	43.3	4.0
R98026	R94037/R94161, **MERLOT**	13	29.3	39.0	45.0	89.0	4.0	36.0	2.5
I19719	SR16-2	14	26.0	33.8	44.0	84.0	3.0	41.5	3.0
MEAN (36)			34.0	33.7	44.9	87.6	2.4	42.7	4.1
LSD (.05)			2.7	1.1	1.3	2.8	1.0	6.1	0.8
CV%			6.7	1.9	1.8	2.7	24.1	12.2	11.5

EXPERIMENT 2109 F5 NAVY AND BLACK BEAN YIELD TRIAL							PLANTED: 6/3/21	
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
B19330	B16501/B15414	116	41.1	44.0	83.0	3.0	50.0	3.0
B20599	B16506/B15430	120	39.6	44.0	84.0	2.0	54.0	5.0
B20597	B16506/B15430	119	39.3	44.0	84.0	2.0	54.0	5.0
19B209-06-02-	B15434/B18504	77	38.8	45.0	83.0	1.0	47.0	5.0
19B240-02-01-	B18204/B18504	94	38.5	43.0	84.0	2.0	50.0	5.0
B19345	B16506/B16507	118	38.0	43.0	84.0	1.0	52.0	5.0
19B245-01-04-	B18210/B18504	98	38.0	44.0	84.0	2.0	49.0	5.0
19B209-07-02-	B15434/B18504	78	37.4	44.0	83.0	2.0	41.0	4.0
19B252-02-02-	B18231/B18233	102	37.3	43.0	83.0	1.0	42.0	4.0
19N109-03-02-	N17506/B18201	19	37.2	45.0	84.0	1.0	49.0	5.0
19N117-03-01-	N18112/B10244	29	37.1	44.0	84.0	1.0	45.0	5.0
19N122-01-01-	N18116/ B15434	38	37.1	45.0	83.0	1.0	52.0	4.0
19B254-04-02-	B18233/B17402	104	36.8	43.0	84.0	2.0	46.0	4.0
19B207-01-02-	B15434/B18204	76	36.6	44.0	84.0	1.0	41.0	4.0
19B229-01-02-	B18201/B10244	87	36.5	44.0	84.0	1.0	44.0	4.0
19B233-04-02-	B18201/B18504	90	36.4	43.0	84.0	1.0	39.0	4.0
19B223-01-01-	B17536/B18504	83	35.9	44.0	84.0	1.0	50.0	4.0
19B252-03-01-	B18231/B18233	103	35.9	44.0	84.0	2.0	44.0	4.0
19B256-04-02-	B18504/B17402	106	35.8	44.0	84.0	1.0	45.0	4.0
19N133-06-03-	N18118/B18504	50	35.7	43.0	83.0	2.0	47.0	5.0
B19309	B15414/B16504	115	35.6	44.0	84.0	1.0	47.0	5.0
B19344	B16506/B16507	117	35.4	43.0	84.0	2.0	49.0	5.0
19N136-05-02-	N18122/B18504	59	35.4	44.0	84.0	2.0	45.0	4.0
19B244-04-02-	B18210/B18232	96	35.2	44.0	83.0	2.0	56.0	5.0
19B256-05-01-	B18504/B17402	107	35.2	44.0	84.0	1.0	53.0	5.0
19B255-01-01-	B18504/B15434	105	35.2	43.0	84.0	1.0	47.0	4.0
19N121-01-01-	N18116/B15430	35	35.0	43.0	83.0	1.0	46.0	5.0
19N122-01-02-	N18116/ B15434	39	35.0	45.0	84.0	2.0	56.0	4.0
19N138-01-02-	N18126/B15430	63	34.8	43.0	84.0	1.0	40.0	4.0
19N137-05-01-	N18126/B10244	62	34.7	44.0	84.0	1.0	45.0	4.0

EXPERIMENT 2109 F5 NAVY AND BLACK BEAN YIELD TRIAL							PLANTED: 6/3/21	
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
B10244	B04644/ZORRO, **ZENITH**	134	34.6	44.0	84.0	1.3	45.8	4.0
19B212-02-03-	B15453/B18504	80	34.6	43.0	84.0	1.0	50.0	5.0
19N137-03-02-	N18126/B10244	61	34.5	44.0	84.0	1.0	41.0	4.0
19N147-03-01-	N18128/B18504	74	34.4	44.0	84.0	1.0	42.0	4.0
19B245-01-01-	B18210/B18504	97	34.4	44.0	83.0	2.0	48.0	5.0
19N138-02-01-	N18126/B15430	64	34.3	44.0	84.0	1.0	45.0	4.0
19N122-08-02-	N18116/ B15434	40	34.2	44.0	83.0	2.0	44.0	4.0
19B259-02-03-	B18504/N18122	108	34.2	44.0	84.0	2.0	45.0	5.0
19N133-02-03-	N18118/B18504	49	34.1	44.0	84.0	1.0	46.0	4.0
B20549	B16501/B16504	122	34.1	43.0	84.0	1.0	48.0	4.0
19B226-03-03-	B17922/B15434	86	34.1	44.0	83.0	1.0	54.0	4.0
19N109-01-02-	N17506/B18201	16	34.0	45.0	84.0	2.0	43.0	4.0
19N101-06-04-	N15306/B10244	7	34.0	45.0	84.0	1.0	52.0	4.0
19N121-03-03-	N18116/B15430	37	34.0	43.0	84.0	2.0	49.0	4.0
19N102-03-02-	N15306/B17023	9	33.9	45.0	84.0	1.0	48.0	4.0
19N122-08-03-	N18116/ B15434	41	33.9	44.0	84.0	1.0	51.0	4.0
19B240-01-02-	B18204/B18504	93	33.9	44.0	84.0	1.0	52.0	5.0
B20602	B16506/B16504	123	33.6	42.0	84.0	1.0	45.0	4.0
19N109-04-03-	N17506/B18201	21	33.5	44.0	83.0	2.0	51.0	5.0
19N128-06-01-	N18117/B10244	46	33.4	44.0	84.0	1.0	50.0	4.0
19B242-01-01-	B18210/B17402	95	33.3	43.0	84.0	4.0	46.0	4.0
19N110-04-02-	N17506/B18233	24	33.2	44.0	84.0	2.0	51.0	5.0
N20404	B16505/N17504	132	33.2	44.0	84.0	1.0	47.0	5.0
B18504	Zenith//Alpena*/B09197, **ADAMS**	133	33.0	44.0	84.0	1.8	45.8	3.8
19B218-02-01-	B17487/B18210	82	33.0	44.0	84.0	2.0	43.0	4.0
19B223-02-02-	B17536/B18504	84	32.9	44.0	84.0	1.0	43.0	5.0
19N137-02-02-	N18126/B10244	60	32.8	43.0	83.0	1.0	52.0	5.0
19N133-01-01-	N18118/B18504	48	32.7	44.0	84.0	1.0	47.0	4.0
19N109-03-01-	N17506/B18201	18	32.6	45.0	83.0	1.0	48.0	4.0
19B230-03-01-	B18201/B17023	88	32.5	45.0	84.0	1.0	44.0	4.0

EXPERIMENT 2109 F5 NAVY AND BLACK BEAN YIELD TRIAL							PLANTED: 6/3/21	
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
19B225-01-01-	B17922/B10244	85	32.2	44.0	84.0	2.0	42.0	4.0
19B248-02-02-	B18231/B17402	100	32.2	43.0	84.0	1.0	41.0	4.0
B20547	B16501/B16504	121	32.1	44.0	84.0	1.0	49.0	4.0
19N139-04-01-	N18126/B15434	65	32.0	44.0	83.0	1.0	42.0	4.0
19N134-03-01-	N18122/N17506	52	31.7	45.0	84.0	1.0	50.0	4.0
19B248-04-01-	B18231/B17402	101	31.6	44.0	83.0	1.0	43.0	4.0
19B259-03-02-	B18504/N18122	109	31.4	44.0	84.0	2.0	49.0	4.0
19B259-04-01-	B18504/N18122	111	31.3	45.0	84.0	2.0	52.0	4.0
19N109-01-03-	N17506/B18201	17	31.2	44.0	84.0	2.0	42.0	4.0
19N124-01-04-	N18116/B18204	42	30.8	44.0	84.0	1.0	42.0	4.0
19N101-02-03-	N15306/B10244	4	30.5	44.0	83.0	1.0	54.0	5.0
19N118-06-02-	N18112/B18504	31	30.4	45.0	83.0	1.0	48.0	4.0
19N120-02-01-	N18116/B10244	33	30.4	44.0	84.0	2.0	52.0	5.0
19N128-01-01-	N18117/B10244	44	30.3	45.0	84.0	1.0	48.0	4.0
19N118-02-01-	N18112/B18504	30	30.2	45.0	84.0	2.0	52.0	4.0
19N147-05-03-	N18128/B18504	75	30.2	44.0	84.0	2.0	49.0	4.0
19N109-04-01-	N17506/B18201	20	30.1	44.0	84.0	1.0	46.0	4.0
19B247-02-01-	B18231/B17269	99	30.1	44.0	84.0	1.0	45.0	4.0
19N102-02-01-	N15306/B17023	8	30.0	45.0	83.0	1.0	47.0	4.0
19N115-02-02-	N18112/N17506	27	29.9	45.0	84.0	2.0	45.0	5.0
19N108-05-02-	N17506/B15453	15	29.8	45.0	83.0	2.0	49.0	4.0
19B216-02-01-	B17269/B18504	81	29.8	44.0	84.0	1.0	46.0	4.0
19N128-08-01-	N18117/B10244	47	29.7	44.0	84.0	2.0	49.0	4.0
B04554	B00103*/X00822, **ZORRO**	114	29.5	44.0	84.0	2.0	52.0	4.0
N19246	N15331/N16405	129	29.3	43.0	84.0	2.0	47.0	5.0
N19253	N15335/N14243	130	29.1	44.0	85.0	1.0	52.0	4.0
19N103-02-01-	N15306/B18201	10	29.0	44.0	84.0	1.0	46.0	4.0
19N145-06-01-	N18128/B18201	66	28.8	44.0	83.0	1.0	36.0	4.0
19N101-01-04-	N15306/B10244	2	28.6	45.0	83.0	1.0	46.0	5.0
19N146-05-01-	N18128/B18231	71	28.5	44.0	84.0	2.0	47.0	5.0

EXPERIMENT 2109 F5 NAVY AND BLACK BEAN YIELD TRIAL							PLANTED: 6/3/21	
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
19B240-01-01-	B18204/B18504	92	28.5	44.0	84.0	2.0	45.0	5.0
19N115-05-03-	N18112/N17506	28	28.5	44.0	84.0	1.0	53.0	5.0
19B231-01-03-	B18201/B17402	89	28.4	43.0	83.0	1.0	42.0	4.0
19N113-02-02-	N18102/B18210	26	28.4	45.0	83.0	3.0	38.0	4.0
19N119-01-02-	N18116/N18122	32	28.3	44.0	83.0	1.0	51.0	4.0
19B259-03-03-	B18504/N18122	110	28.2	44.0	84.0	2.0	45.0	4.0
19N134-02-03-	N18122/N17506	51	28.2	44.0	84.0	2.0	48.0	4.0
19N127-05-02-	N18116/B18504	43	28.2	44.0	84.0	2.0	51.0	4.0
19N136-01-02-	N18122/B18504	58	28.2	44.0	84.0	1.0	44.0	4.0
19N146-01-01-	N18128/B18231	68	28.0	44.0	83.0	1.0	47.0	4.0
19N101-02-01-	N15306/B10244	3	27.8	44.0	84.0	1.0	55.0	5.0
19B234-06-01-	B18204/B10244	91	27.2	43.0	84.0	1.0	45.0	4.0
19N106-02-01-	N17506/N18116	14	27.2	45.0	84.0	1.0	52.0	5.0
19N134-03-03-	N18122/N17506	54	27.0	44.0	84.0	2.0	46.0	4.0
19N128-01-02-	N18117/B10244	45	26.9	45.0	84.0	1.0	52.0	4.0
19B212-01-01-	B15453/B18504	79	26.9	44.0	84.0	1.0	47.0	4.0
19N135-01-04-	N18122/B10244	56	26.8	45.0	84.0	1.0	39.0	4.0
19N146-04-01-	N18128/B18231	70	26.7	45.0	83.0	1.0	45.0	4.0
19N121-03-01-	N18116/B15430	36	26.6	44.0	86.0	1.0	48.0	4.0
19N147-01-02-	N18128/B18504	73	26.0	44.0	84.0	1.0	40.0	4.0
19N103-03-03-	N15306/B18201	11	25.8	44.0	85.0	2.0	47.0	4.0
I20815	**VALIANT**	135	25.4	39.0	83.0	2.2	41.7	3.0
19N101-06-02-	N15306/B10244	6	25.4	44.0	84.0	1.0	48.0	4.0
19N106-01-02-	N17506/N18116	13	25.3	45.0	84.0	1.0	41.0	4.0
19N110-03-02-	N17506/B18233	23	25.2	44.0	84.0	2.0	50.0	5.0
19N110-03-01-	N17506/B18233	22	25.2	44.0	84.0	1.0	44.0	4.0
19N146-05-03-	N18128/B18231	72	25.1	44.0	84.0	1.0	48.0	4.0
19N113-01-03-	N18102/B18210	25	25.0	45.0	83.0	2.0	46.0	4.0
19N134-07-01-	N18122/N17506	55	24.8	44.0	84.0	2.0	51.0	4.0
19N135-03-02-	N18122/B10244	57	24.6	44.0	84.0	1.0	39.0	4.0

EXPERIMENT 2109 F5 NAVY AND BLACK BEAN YIELD TRIAL							PLANTED: 6/3/21	
NAME	**PEDIGREE**	**ENTRY**	**YIELD CWT /ACRE**	**DAYS TO FLOWER**	**DAYS TO MATURITY**	**LODGING (1-5)**	**HEIGHT (cm)**	**DES. SCORE**
19N146-03-01-	N18128/B18231	69	24.6	44.0	84.0	1.0	43.0	4.0
I19703	BL14506, **BLACK BEARD**	112	24.5	43.0	84.0	2.0	49.0	3.0
19N101-01-01-	N15306/B10244	1	24.1	45.0	83.0	1.0	47.0	5.0
19N134-03-02-	N18122/N17506	53	24.1	45.0	84.0	2.0	56.0	5.0
I21901	BL14500, **NIMBUS**	124	23.4	44.0	84.0	2.0	46.0	4.0
N18103	N13120/PR00806-81	126	23.4	44.0	83.0	1.0	42.0	4.0
N19226	N14243/N15326	128	22.8	44.0	84.0	2.0	46.0	4.0
19N145-07-03-	N18128/B18201	67	22.2	43.0	84.0	2.0	50.0	4.0
I17501	Jaguar/BL05222, **BLACK BEAR**	113	21.8	44.0	84.0	2.0	48.0	3.0
19N120-05-02-	N18116/B10244	34	21.3	44.0	83.0	2.0	45.0	4.0
I21920	**HMS BOUNTY**	131	21.2	44.0	84.0	2.0	50.0	4.0
N19285	G14505/X16708	127	20.9	44.0	84.0	3.0	41.0	3.0
N11283	MEDALIST/N08003, **ALPENA**	125	19.4	43.0	84.0	2.0	36.0	4.0
19N101-02-04-	N15306/B10244	5	19.1	44.0	83.0	1.0	40.0	4.0
MEAN (134)			31.1	44.0	83.2	1.5	46.5	4.2
LSD (.05)			-	1.0	1.4	1.0	7.0	1.6
CV%			9.0	1.1	0.8	32.8	7.0	17.3

EXPERIMENT 2110 F5 GN, PINTO, RED, AND PINK BEAN YIELD TRIAL							PLANTED: 6/3/21	
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
19S608-08-01-	S18909/R18403	83	42.3	45.0	86.0	2.0	42.0	4.0
19R514-04-02-	R17605/S18904	64	41.5	44.0	87.0	2.0	55.0	5.0
19R501-07-01-	R17602/R18401	59	41.4	45.0	83.0	2.0	51.0	4.0
19S604-02-02-	S17706/R18401	77	41.3	41.0	90.0	2.0	53.0	4.0
19R514-01-01-	R17605/S18904	63	40.9	45.0	87.0	3.0	48.0	4.0
19R510-08-01-	R17604/S18909	61	40.2	45.0	85.0	2.0	46.0	5.0
P16901	Eldorado/P11519, **CHARRO**	93	39.7	44.0	83.0	2.0	48.3	4.0
19R512-02-02-	R17605/R18403	62	39.2	45.0	83.0	3.0	55.0	4.0
19R516-03-02-	R18401/R17603	70	39.2	44.0	83.0	1.0	54.0	5.0
19P426-02-02-	P18603/P16901	46	38.9	47.0	82.0	3.0	54.0	3.0
19R515-07-01-	R17605/S18909	69	38.3	47.0	90.0	2.0	50.0	5.0
19S610-01-01-	S18909/R17605	84	37.8	47.0	88.0	2.0	46.0	3.0
19G311-01-04-	G16345/G08254	8	37.4	40.0	82.0	2.0	47.0	4.0
19G320-03-01-	G18505/G16346	14	36.9	41.0	82.0	2.0	52.0	4.0
19S606-01-01-	S18907/R17602	79	36.7	44.0	87.0	3.0	50.0	4.0
19R515-04-01-	R17605/S18909	67	36.4	46.0	91.0	3.0	44.0	3.0
19R520-04-02-	R18403/R17604	72	36.3	45.0	83.0	2.0	44.0	4.0
R12844	SR9-5/R09508, **CAYENNE**	91	36.2	44.0	80.0	2.5	50.4	4.0
19G307-05-02-	G16301/G17418	21	35.7	41.0	84.0	1.0	47.0	4.0
19P440-07-02-	X18504/P18601	50	35.5	40.0	82.0	1.0	54.0	5.0
G16351	Eldorado/G13467, **EIGER**	92	34.7	42.0	83.0	2.7	45.7	4.0
19R501-05-01-	R17602/R18401	58	34.6	44.0	83.0	2.0	55.0	5.0
19P432-02-03-	I18623/P16901	54	34.4	43.0	83.0	1.0	55.0	5.0
19G310-03-02-	G16318/I17544	6	34.2	39.0	82.0	2.0	49.0	5.0
19R511-02-02-	R17605/R18401	75	34.1	44.0	83.0	3.0	55.0	4.0
19R509-08-01-	R17603/S18909	60	33.9	43.0	86.0	2.0	47.0	4.0
19R520-05-02-	R18403/R17604	73	33.9	44.0	83.0	3.0	46.0	4.0
19P413-06-02-	P16905/G16351	30	33.8	44.0	83.0	3.0	52.0	4.0
19P414-11-01-	P16905/I18623	36	33.7	41.0	83.0	2.0	50.0	4.0
19P413-08-02-	P16905/G16351	31	33.5	44.0	84.0	2.0	55.0	4.0

EXPERIMENT 2110 F5 GN, PINTO, RED, AND PINK BEAN YIELD TRIAL							PLANTED: 6/3/21	
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
19R518-03-01-	R18401/S18904	71	33.4	45.0	86.0	2.0	46.0	5.0
19P413-03-01-	P16905/G16351	27	33.4	45.0	83.0	2.0	52.0	5.0
19S608-04-01-	S18909/R18403	82	33.0	46.0	89.0	3.0	38.0	3.0
19R515-03-02-	R17605/S18909	66	33.0	44.0	88.0	1.0	53.0	5.0
19P426-03-01-	P18603/P16901	47	32.7	46.0	83.0	2.0	54.0	3.0
19S610-02-01-	S18909/R17605	85	32.7	45.0	89.0	3.0	48.0	4.0
19P414-10-01-	P16905/I18623	34	32.7	44.0	82.0	1.0	54.0	5.0
19R514-05-01-	R17605/S18904	65	32.6	44.0	88.0	2.0	49.0	4.0
19S606-04-01-	S18907/R17602	81	32.4	44.0	89.0	3.0	45.0	3.0
19R515-05-02-	R17605/S18909	68	32.4	46.0	88.0	2.0	47.0	5.0
19G311-01-03-	G16345/G08254	7	32.2	42.0	83.0	2.0	48.0	4.0
19S606-02-01-	S18907/R17602	80	32.1	44.0	89.0	3.0	47.0	4.0
19P436-04-01-	X18503/P17401	42	32.1	43.0	83.0	2.0	48.0	4.0
19S604-05-02-	S17706/R18401	78	32.0	46.0	92.0	3.0	43.0	3.0
19S607-04-02-	S18907/R17605	89	31.6	47.0	83.0	3.0	44.0	4.0
19P414-10-02-	P16905/I18623	35	31.5	43.0	82.0	2.0	52.0	4.0
19P432-02-02-	I18623/P16901	53	31.4	43.0	82.0	2.0	46.0	4.0
19P406-01-02-	P16901/X18504	24	30.7	39.0	84.0	2.0	52.0	4.0
19R521-01-02-	R18403/S18904	74	29.8	44.0	82.0	3.0	48.0	3.0
19P444-04-02-	X18505/P17401	45	29.1	38.0	82.0	2.0	41.0	5.0
19G307-03-01-	G16301/G17418	20	29.0	39.0	84.0	2.0	46.0	5.0
19P404-02-02-	P16901/I18623	22	28.9	40.0	83.0	2.0	51.0	4.0
19P438-02-01-	X18503/X18506	51	28.9	39.0	85.0	3.0	43.0	3.0
19P414-05-04-	P16905/I18623	32	28.9	43.0	83.0	3.0	50.0	3.0
19R501-04-01-	R17602/R18401	57	28.7	42.0	83.0	2.0	54.0	5.0
19S610-02-03-	S18909/R17605	86	28.4	44.0	87.0	2.0	49.0	4.0
19G320-02-01-	G18505/G16346	13	28.4	42.0	83.0	3.0	46.0	4.0
19P429-03-01-	P18603/X18505	39	28.3	39.0	82.0	3.0	47.0	3.0
I18623	PT16-9, **USDA DIAMONDBACK**	90	28.0	40.0	82.0	2.0	52.0	3.0
19P434-04-01-	I18623/X18503	55	28.0	44.0	83.0	2.0	52.0	4.0

EXPERIMENT 2110 F5 GN, PINTO, RED, AND PINK BEAN YIELD TRIAL							PLANTED: 6/3/21	
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
19S607-03-01-	S18907/R17605	88	28.0	44.0	82.0	3.0	46.0	3.0
19G304-02-01-	G08254/G17410	1	28.0	38.0	82.0	2.0	37.0	4.0
19G320-05-02-	G18505/G16346	15	28.0	40.0	84.0	2.0	49.0	5.0
19P437-01-01-	X18503/P18601	43	27.8	42.0	82.0	3.0	50.0	3.0
19P413-03-03-	P16905/G16351	28	27.8	44.0	82.0	3.0	46.0	4.0
19P444-03-01-	X18505/P17401	44	27.2	39.0	83.0	2.0	48.0	4.0
19G323-01-01-	I17544/G17410	18	27.1	39.0	82.0	2.0	47.0	4.0
19P434-04-02-	I18623/X18503	56	26.8	44.0	88.0	2.0	47.0	4.0
19P420-01-01-	P17401/X18504	38	26.7	43.0	83.0	2.0	46.0	4.0
19P406-06-01-	P16901/X18504	26	26.6	38.0	84.0	2.0	38.0	4.0
19P413-04-01-	P16905/G16351	29	26.2	43.0	83.0	2.0	53.0	5.0
19P436-03-01-	X18503/P17401	41	26.1	42.0	83.0	2.0	42.0	3.0
19G310-02-02-	G16318/I17544	5	25.9	38.0	82.0	3.0	47.0	4.0
19S610-05-01-	S18909/R17605	87	25.7	44.0	82.0	2.0	48.0	3.0
19G301-01-02-	G08254/G16305	19	25.7	41.0	82.0	2.0	49.0	4.0
19P440-04-01-	X18504/P18601	49	25.4	38.0	82.0	2.0	43.0	4.0
19G311-03-01-	G16345/G08254	9	25.4	39.0	82.0	2.0	47.0	4.0
19P414-09-03-	P16905/I18623	33	25.0	44.0	82.0	3.0	49.0	3.0
19P440-01-01-	X18504/P18601	48	24.9	38.0	83.0	2.0	50.0	4.0
19G309-02-01-	G16318/G18505	4	23.6	37.0	82.0	2.0	47.0	4.0
19S604-01-01-	S17706/R18401	76	23.1	40.0	85.0	3.0	44.0	3.0
19P406-01-01-	P16901/X18504	23	22.8	39.0	84.0	3.0	47.0	4.0
19P433-02-01-	I18623/P17401	40	22.4	41.0	84.0	2.0	47.0	3.0
19G315-05-02-	G17410/G08254	11	20.9	38.0	82.0	3.0	46.0	3.0
19P424-03-02-	P18601/G16301	52	19.5	40.0	82.0	3.0	49.0	3.0
19G304-06-02-	G08254/G17410	2	19.0	39.0	82.0	2.0	46.0	4.0
19G309-01-01-	G16318/G18505	3	18.9	39.0	82.0	3.0	45.0	3.0
19G321-04-01-	I17544/G08254	17	18.6	38.0	82.0	2.0	35.0	3.0
19G321-03-02-	I17544/G08254	16	17.7	39.0	82.0	3.0	36.0	3.0
19G319-02-02-	G18505/G08254	12	17.0	39.0	82.0	2.0	45.0	4.0

EXPERIMENT 2110 F5 GN, PINTO, RED, AND PINK BEAN YIELD TRIAL								PLANTED: 6/3/21
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
19P406-05-02-	P16901/X18504	25	16.6	38.0	85.0	2.0	43.0	3.0
19G312-01-01-	G16351/G08254	10	14.3	39.0	82.0	2.0	35.0	3.0
19P418-08-01-	P17401/G08254	37	11.3	40.0	82.0	3.0	37.0	3.0
MEAN (93)			31.5	42.2	83.9	2.3	47.6	3.9
LSD (.05)			-	0.8	33.7	1.1	2.6	1.0
CV%			6.8	0.9	19.0	21.7	2.5	12.1

EXPERIMENT 2111 MDP PANEL YIELD TRIAL (SMALL SEEDED)						PLANTED: 6/3/21		
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)
BC395	Black Velvet	95	33.4	25.0	45.0	86.0	2.5	49.5
BC051	F04-2801-4-5-1	8	31.4	22.2	44.0	83.0	2.5	48.0
BC097	N05324	34	30.1	20.3	45.0	83.0	1.0	52.0
BC085	Jaguar	27	29.4	18.6	44.0	83.0	1.5	41.0
BC124	Shania	37	29.2	22.0	45.0	83.0	2.0	47.5
BC084	Phantom	26	28.2	21.8	44.0	82.0	2.0	49.0
BC096	Cornell 49-242	33	27.9	22.2	48.0	81.0	4.0	30.5
BC320	Vista	71	27.5	20.3	42.0	85.0	2.0	46.0
BC215	A-55	51	27.4	24.0	45.0	88.0	2.0	52.0
BC145	Midnight	46	27.1	21.6	45.0	84.0	2.0	45.0
BC126	Loreto	39	25.8	21.1	45.0	83.0	2.0	44.5
BC350	AC Harblack	85	25.7	22.9	42.0	83.0	2.5	39.0
BC310	ND021717	67	25.6	20.3	45.0	83.0	1.5	45.0
BC146	Black Knight	47	25.5	21.7	46.0	83.0	2.5	46.5
BC354	T9905	88	25.4	22.9	42.0	85.0	2.5	44.5
BC127	Schooner	40	25.3	20.2	41.0	82.0	3.0	30.0
BC050	F04-2801-4-6-6	7	25.0	23.6	43.0	84.0	2.0	47.5
BC032	DPC-4	3	24.9	22.4	43.0	83.0	1.5	43.5
BC090	B05055	31	24.6	21.1	44.0	83.0	1.0	38.5
BC033	PR 0443-151	4	24.5	19.1	45.0	82.0	3.0	40.5
BC066	C-20	18	24.5	20.7	43.0	88.0	3.0	44.5
BC319	Reliant	70	24.5	19.8	44.0	85.0	2.0	38.0
BC336	OAC Rex	78	24.5	22.4	42.0	89.0	2.0	39.5
BC068	Mayflower	20	24.3	18.2	44.0	83.0	1.0	47.5
BC067	Laker	19	24.0	20.8	46.0	87.0	3.0	42.5
BC341	Fleetwood	80	23.8	19.1	45.0	88.0	3.0	37.0
BC063	Black Magic	16	23.8	23.1	44.0	83.0	1.5	48.0
BC069	Blackhawk	21	23.7	23.8	45.0	83.0	1.5	43.5
BC056	Seafarer	12	23.5	21.5	41.0	88.0	3.0	34.5
BC339	Nautica	79	23.2	19.4	44.0	83.0	1.0	44.5

EXPERIMENT 2111 MDP PANEL YIELD TRIAL (SMALL SEEDED)						PLANTED: 6/3/21		
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)
BC086	Seahawk	28	23.0	24.1	43.0	82.0	3.5	29.5
BC053	F04-2801-4-1-2	9	22.7	24.4	43.0	84.0	3.0	42.5
BC088	Zorro	30	22.6	20.0	45.0	83.0	1.0	47.5
BC349	Harrowhawk	84	22.5	20.2	45.0	88.0	2.0	48.5
BC307	Eclipse	66	22.2	20.0	43.0	83.0	1.5	45.0
BC134	Navigator	45	22.1	20.2	42.0	85.0	1.0	47.5
BC075	Raven	23	22.0	18.4	44.0	83.0	1.0	48.0
BC287	A801	60	21.8	21.6	45.0	82.0	3.5	41.5
BC062	Domino	15	21.6	19.9	45.0	83.0	2.0	48.0
BC027	Xan 176	2	21.5	24.9	47.0	83.0	3.0	46.5
BC087	Condor	29	21.5	21.4	43.0	83.0	3.0	34.5
BC047	F07-004-9-1	6	21.1	20.8	43.0	84.0	2.0	47.0
BC130	Seabiskit	43	21.1	18.5	42.0	87.0	3.0	42.0
BC322	Blackjack	73	20.9	21.6	41.0	83.0	3.0	34.5
BC078	Mackinac	25	20.8	19.6	42.0	86.0	2.0	46.5
BC327	CDC Whitecap	75	20.8	21.7	42.0	84.0	3.0	36.0
BC286	A285	59	20.6	22.9	44.0	82.0	3.0	34.5
BC125	Bandit	38	20.6	21.0	44.0	82.0	2.0	43.0
BC216	I9365-31	52	20.4	24.5	45.0	82.0	3.5	32.5
BC311	ND021574	68	20.2	24.5	44.0	83.0	2.0	47.5
BC060	Swan Valley	13	20.2	19.5	44.0	88.0	3.0	45.0
BC104	115M (Black Rhino)	35	20.2	22.0	45.0	82.0	3.0	43.0
BC061	Neptune	14	20.1	18.9	46.0	88.0	2.5	41.5
BC346	Lightning	83	20.0	21.5	42.0	84.0	2.0	45.0
BC392	Albion	92	19.9	21.9	41.0	81.0	4.0	36.0
BC352	OAC Seaforth	86	19.3	24.7	39.0	89.0	3.0	31.5
BC343	OAC Gryphon	82	18.7	19.5	41.0	85.0	3.0	34.5
BC290	BAT 477	61	18.7	25.6	43.0	81.0	4.0	29.5
BC092	T-39	32	18.6	20.0	44.0	83.0	3.5	38.5
BC129	Voyager	42	18.4	21.3	40.0	85.0	3.0	28.5

EXPERIMENT 2111 MDP PANEL YIELD TRIAL (SMALL SEEDED)						PLANTED: 6/3/21		
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)
BC355	T9903	89	18.4	24.3	42.0	83.0	3.0	43.0
BC372	UCD 96114	91	18.1	19.7	44.0	82.0	1.0	40.5
BC106	Puebla 152	36	18.0	23.9	48.0	96.0	5.0	36.0
BC074	Huron	22	18.0	20.4	42.0	88.0	2.5	40.0
BC403	McHale	96	17.9	21.8	41.0	83.0	2.0	41.5
BC041	Aifi Wuriti	5	17.6	23.5	42.0	83.0	2.5	47.0
BC394	Midland	94	17.4	19.1	42.0	82.0	3.0	30.0
BC331	CDC Expresso	76	17.4	25.5	38.0	87.0	1.5	38.5
BC332	CDC Jet	77	17.3	23.9	42.0	83.0	2.0	45.5
BC133	Medalist	44	17.3	20.1	43.0	87.0	2.5	45.5
BC077	Newport	24	17.1	21.1	41.0	83.0	2.5	37.0
BC065	Bunsi	17	16.9	21.6	42.0	88.0	3.0	34.5
BC055	Sanilac	11	16.7	24.0	39.0	88.0	2.0	32.0
BC213	Morden 003	50	16.4	21.6	40.0	90.0	2.0	40.0
BC342	OAC Laser	81	16.3	22.8	40.0	87.0	2.0	39.5
BC305	Norstar	64	16.2	18.4	46.0	86.0	2.0	48.5
BC324	CDC Nighthawk	74	16.1	21.7	41.0	83.0	2.0	40.5
BC219	ICB-3	55	15.8	25.9	44.0	80.0	4.5	28.5
BC173	UI-911	49	15.7	23.1	42.0	80.0	3.0	35.5
BC304	Arthur	63	15.7	17.7	45.0	89.0	2.5	48.5
BC291	SEA 10	62	15.3	33.4	42.0	81.0	4.5	27.5
BC353	AC Compass	87	15.0	21.0	41.0	83.0	3.0	40.0
BC317	Crestwood	69	14.8	21.2	41.0	87.0	3.5	31.0
BC217	92BG-7	53	14.3	22.8	42.0	81.0	3.5	33.0
BC128	Ensign	41	14.0	22.3	43.0	84.0	3.0	34.0
BC356	HY 4181	90	13.4	21.4	44.0	82.0	2.0	42.0
BC259	Hyden	57	12.0	22.2	40.0	81.0	4.0	31.0
BC306	Avalanche	65	11.6	20.6	41.0	82.0	3.0	36.5
BC258	NW-395	56	11.4	23.1	41.0	81.0	4.0	30.0
BC393	Avanti	93	11.0	19.8	41.0	82.0	3.0	32.5

EXPERIMENT 2111 MDP PANEL YIELD TRIAL (SMALL SEEDED)						PLANTED: 6/3/21		
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)
BC218	ICB-10	54	10.5	25.4	42.0	83.0	2.0	42.5
BC010	AC Black Diamond	1	10.4	31.3	41.0	86.0	2.0	38.0
BC172	UI-906	48	10.1	20.0	42.0	83.0	2.0	38.5
BC054	Michelite	10	8.6	18.7	48.0	82.0	4.0	31.0
BC321	Envoy	72	6.5	21.4	39.0	83.0	3.0	33.5
BC260	USWA-50	58	5.7	18.3	41.0	82.0	4.5	29.5
MEAN (96)			20.1	21.8	42.8	83.9	2.5	40.2
LSD (.05)			3.3	1.2	1.8	2.3	0.7	5.5
CV%			10.0	3.2	2.6	1.7	15.5	8.3

EXPERIMENT 2112 MDP PANEL YIELD TRIAL (MEDIUM SEEDED)						PLANTED: 6/3/21		
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)
BC049	F07-014-22-2	87	31.9	38.5	42.0	84.0	3.0	41.0
BC091	P07863, ELDORADO	90	31.4	44.4	42.0	83.0	3.0	40.0
BC301	Stampede	9	31.3	40.7	42.0	83.0	3.0	42.0
BC028	PR 0340-3-3-1	58	31.1	28.9	44.0	85.0	2.5	44.5
BC094	Sedona	27	30.9	39.1	43.0	83.0	3.5	33.0
BC026	DOR 364	19	30.6	23.8	45.0	82.0	3.5	28.0
BC093	Merlot	11	30.3	39.5	44.0	83.0	3.0	38.0
BC031	Verano	4	30.1	24.9	43.0	83.0	3.0	32.5
BC295	SR9-4	155	29.9	33.3	43.0	83.0	2.5	48.0
BC303	Frontier	156	29.6	42.2	45.0	83.0	3.0	37.0
BC123	Sonora	97	29.4	39.4	41.0	83.0	3.0	42.5
BC099	S08418, ROSETTA	91	29.2	35.8	44.0	83.0	3.0	43.0
BC018	Grand Mesa	76	29.0	38.4	43.0	83.0	3.0	39.0
BC121	Baja	95	28.7	40.5	42.0	86.0	3.0	35.0
BC212	AC Scarlet	133	28.3	39.5	42.0	81.0	4.0	32.0
BC048	F07-449-9-3	22	28.3	33.3	45.0	83.0	3.0	43.0
BC292	PK9-7	153	28.3	42.2	42.0	82.0	3.5	36.0
BC120	La Paz	31	27.9	38.1	44.0	83.0	3.0	39.5
BC038	CENTA Pupil	21	27.6	23.8	43.0	83.0	2.0	40.5
BC044	TARS09-RR023	85	27.6	28.9	47.0	83.0	4.0	29.5
BC373	UCD 9634	8	27.5	35.3	42.0	81.0	3.5	37.0
BC040	Dehoro	82	27.4	28.7	42.0	83.0	3.0	35.5
BC270	I9365-5	149	27.4	30.2	48.0	86.0	3.0	40.5
BC194	Coyne	12	27.3	40.6	42.0	83.0	3.0	30.5
BC234	PT7-2	51	27.2	36.7	42.0	83.0	3.0	40.0
BC030	Morales	3	27.1	23.0	49.0	85.0	4.0	25.0
BC192	Weihing	43	27.1	41.9	42.0	86.0	3.5	33.0
BC326	CDC Pinnacle	161	27.0	50.5	42.0	81.0	4.5	23.0
BC014	AC Resolute	73	26.8	43.1	40.0	87.0	3.0	38.0
BC312	ND041062-1	158	26.8	37.6	42.0	83.0	2.0	52.0

EXPERIMENT 2112 MDP PANEL YIELD TRIAL (MEDIUM SEEDED)						PLANTED: 6/3/21		
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)
BC203	NE2-09-1	125	25.9	44.2	41.0	82.0	4.0	15.5
BC142	ROG 312	35	25.8	38.6	40.0	83.0	4.0	30.0
BC180	BelNeb 2	111	25.7	36.9	44.0	83.0	4.5	26.0
BC016	Bill Z	14	25.6	43.5	42.0	81.0	4.5	27.0
BC302	ND-307	62	25.5	39.0	42.0	83.0	3.0	38.5
BC204	NE2-09-3	46	25.2	45.7	42.0	83.0	3.5	38.0
BC022	Shiny Crow	17	25.1	25.9	42.0	85.0	4.0	31.0
BC236	USPT-CBB-1	52	25.0	39.7	44.0	83.0	4.0	30.0
BC043	TARS09-RR007	84	24.9	27.4	41.0	82.0	4.0	28.5
BC011	AC Island	71	24.8	46.3	40.0	83.0	4.0	32.0
BC195	ABCP-8	44	24.6	36.3	47.0	82.0	4.5	26.0
BC271	Rojo Chiquito	150	24.6	23.4	45.0	83.0	2.5	42.5
BC143	Desert Rose	101	24.6	33.6	42.0	82.0	4.0	26.0
BC178	UI-114	42	24.5	41.6	42.0	81.0	5.0	23.5
BC167	UI-126	107	24.2	42.9	42.0	82.0	4.5	24.0
BC206	NE2-09-8	127	24.2	37.1	46.0	86.0	4.0	24.5
BC168	UI-196	108	24.1	39.7	45.0	82.0	4.5	30.5
BC391	Vision	168	23.7	39.0	45.0	88.0	4.0	37.0
BC181	BelMiNeb 1	112	23.7	35.1	42.0	84.0	2.0	42.5
BC182	BelMiNeb 2	113	23.6	37.4	42.0	85.0	3.5	29.5
BC037	IBC 301-204	20	23.6	27.8	42.0	81.0	4.5	28.0
BC235	USPT-WM-1	142	23.6	40.0	42.0	86.0	3.5	31.0
BC297	GN9-1	60	23.6	39.3	41.0	82.0	4.0	31.5
BC298	PT9-17	61	23.5	36.3	44.0	84.0	4.0	17.5
BC200	NE1-09-19	122	23.4	39.7	42.0	82.0	4.0	28.0
BC070	Sierra	23	23.4	36.6	45.0	86.0	3.5	35.5
BC029	Amadeus 77	79	23.1	26.8	42.0	83.0	2.5	33.5
BC268	USWA-61	148	23.1	32.4	42.0	86.0	2.0	48.0
BC375	Yolano	65	23.1	36.8	41.0	83.0	4.0	34.0
BC205	NE2-09-4	126	23.1	38.8	42.0	83.0	3.5	31.0

EXPERIMENT 2112 MDP PANEL YIELD TRIAL (MEDIUM SEEDED)						PLANTED: 6/3/21		
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)
BC020	Montrose	16	22.9	46.0	43.0	81.0	5.0	24.5
BC222	Quincy	47	22.9	37.4	42.0	83.0	4.5	27.5
BC202	NE1-09-22	124	22.7	36.5	42.0	83.0	3.5	32.0
BC242	NW-63	53	22.7	34.2	41.0	88.0	4.5	30.0
BC045	TARS09-RR029	86	22.6	22.7	44.0	83.0	3.0	41.0
BC039	INTA Precoz	81	22.5	26.2	42.0	84.0	3.0	36.5
BC243	USRM-20	54	22.3	42.2	44.0	82.0	4.0	31.0
BC109	Poncho	28	22.3	45.6	42.0	81.0	4.5	22.0
BC132	Red Ryder	98	22.2	39.5	43.0	82.0	4.5	27.0
BC199	NE1-09-13	121	22.1	32.7	43.0	83.0	3.0	35.5
BC266	6R-42	147	22.1	36.3	45.0	88.0	4.0	26.5
BC115	Remington	94	22.1	43.0	42.0	83.0	3.5	33.0
BC131	Pink Floyd	32	22.1	37.7	41.0	83.0	4.0	30.0
BC162	Common Red Mexican	37	22.1	38.2	42.0	84.0	4.0	29.0
BC023	San Juan	18	22.0	47.2	43.0	81.0	5.0	22.0
BC024	Croissant	10	21.9	45.4	42.0	81.0	5.0	21.0
BC308	NDZ06249	157	21.9	33.3	44.0	83.0	3.0	39.0
BC273	Orca	5	21.8	32.8	44.0	83.0	3.0	40.5
BC223	Burke	136	21.6	46.3	41.0	83.0	4.0	27.0
BC233	NW-410	141	21.5	39.9	45.0	82.0	5.0	26.5
BC296	GN9-4	59	21.5	37.8	42.0	83.0	3.0	39.5
BC294	SR7-3	154	21.5	42.8	41.0	82.0	4.0	26.5
BC224	TARS-VCI-4B	48	21.5	25.0	49.0	91.0	4.0	30.0
BC177	UI-111	110	21.5	42.4	42.0	82.0	4.0	26.0
BC209	AC Pintoba	130	21.4	42.2	43.0	84.0	3.5	31.5
BC163	IP08-2	105	21.3	36.0	48.0	89.0	4.0	32.0
BC113	Fargo	93	21.3	47.7	39.0	81.0	4.0	32.5
BC384	Fiesta	165	21.2	51.1	41.0	81.0	4.0	30.5
BC073	Aztec	89	21.2	44.6	40.0	82.0	4.0	32.5
BC164	Kimberly	38	21.0	21.0	43.0	81.0	4.5	28.5

EXPERIMENT 2112 MDP PANEL YIELD TRIAL (MEDIUM SEEDED)						PLANTED: 6/3/21		
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)
BC383	Apache	164	21.0	42.9	44.0	82.0	4.0	31.0
BC176	UI-59	41	21.0	39.2	42.0	80.0	5.0	26.0
BC207	NE2-09-10	128	20.9	40.1	43.0	83.0	3.0	42.5
BC272	Indeterminate Jamaica Red	151	20.8	41.1	48.0	83.0	4.0	32.5
BC323	GTS-900	160	20.8	41.5	43.0	83.0	4.0	32.5
BC052	I06-2575-17	88	20.8	27.4	42.0	87.0	3.5	36.5
BC009	AC Redbond	70	20.7	41.2	40.0	83.0	3.0	39.5
BC197	ABCP-15	120	20.7	38.2	44.0	82.0	4.5	28.5
BC122	Durango	96	20.6	44.2	41.0	84.0	3.0	34.0
BC230	92US-1006	140	20.6	38.3	42.0	83.0	4.0	26.5
BC001	BelMiNeb-RR-2	67	20.5	32.1	43.0	84.0	3.0	35.0
BC374	UCD 9623	163	20.4	38.6	41.0	84.0	3.0	35.5
BC080	Matterhorn	25	20.3	37.3	41.0	83.0	3.0	40.0
BC201	NE1-09-20	123	20.2	37.5	42.0	83.0	3.0	38.5
BC221	USWA-12	135	20.2	39.1	46.0	88.0	4.0	30.0
BC231	Othello	49	20.2	44.2	41.0	82.0	4.0	32.0
BC232	NW-590	50	20.0	38.4	44.0	86.0	4.5	25.0
BC210	AC Ole	131	20.0	45.8	41.0	83.0	4.0	30.5
BC019	Fisher	15	19.9	39.5	48.0	88.0	5.0	24.5
BC003	BelDakMi-RR-5	69	19.9	39.0	41.0	83.0	3.5	36.0
BC035	PR 0401-259	80	19.5	24.3	43.0	83.0	2.0	43.0
BC025	Arapaho	78	19.5	37.9	42.0	82.0	5.0	19.5
BC112	Flint	92	19.5	42.8	41.0	81.0	5.0	23.0
BC042	TARS09-RR004	83	19.4	24.9	44.0	83.0	2.0	41.0
BC190	Starlight	117	19.4	42.8	41.0	88.0	3.5	32.0
BC278	Viva	56	19.3	28.2	49.0	83.0	4.0	24.5
BC170	UI-239	40	19.2	35.7	42.0	82.0	4.0	27.0
BC358	Orion	64	18.8	35.7	41.0	83.0	3.5	31.5
BC316	Hatton	159	18.8	41.9	42.0	82.0	4.5	26.0
BC229	Holberg	139	18.8	35.2	42.0	84.0	5.0	24.0

EXPERIMENT 2112 MDP PANEL YIELD TRIAL (MEDIUM SEEDED)						PLANTED: 6/3/21		
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)
BC141	Garnet	100	18.7	35.0	42.0	81.0	4.5	25.5
BC159	UI-37	104	18.7	33.4	44.0	86.0	5.0	24.5
BC282	URS-117	152	18.7	30.9	48.0	88.0	4.0	28.0
BC267	Victor	55	18.6	37.6	44.0	82.0	4.5	28.0
BC196	Chase	45	18.6	37.7	43.0	81.0	5.0	24.0
BC240	Big Bend	144	18.5	41.0	45.0	83.0	5.0	24.0
BC160	UI-537	36	18.4	42.1	42.0	82.0	5.0	23.0
BC138	Marquis	34	18.3	37.5	41.0	83.0	4.0	29.5
BC333	CDC Rosalee	162	18.3	33.7	41.0	83.0	3.5	36.0
BC007	BelNeb-RR-1	13	18.2	32.5	45.0	85.0	5.0	22.5
BC157	Shoshone	102	18.2	45.1	41.0	82.0	4.0	28.5
BC089	Santa Fe	26	17.9	42.5	42.0	83.0	4.0	33.0
BC225	JM-126	137	17.5	42.1	46.0	84.0	5.0	28.0
BC015	AC Earlired	74	17.5	39.7	41.0	81.0	4.0	25.5
BC257	USWA-13	146	17.5	49.1	42.0	83.0	4.0	24.0
BC110	Topaz	29	17.5	41.5	39.0	80.0	4.5	24.0
BC165	Sawtooth	39	17.3	17.6	48.0	93.0	4.0	32.5
BC169	UI-228	109	17.1	40.3	42.0	82.0	4.0	31.0
BC390	Focus	167	16.9	39.6	45.0	84.0	3.5	32.5
BC186	GN Harris	115	16.7	34.6	48.0	88.0	5.0	23.5
BC191	Emerson	118	16.6	51.3	40.0	83.0	4.0	26.0
BC079	Kodiak	24	16.5	43.3	42.0	82.0	4.0	30.0
BC279	Roza	57	16.5	35.5	45.0	85.0	4.0	24.5
BC386	Buster	66	16.4	42.0	41.0	82.0	4.0	32.0
BC012	AC Early Rose	72	16.3	41.1	41.0	80.0	4.5	27.5
BC385	Bighorn	166	16.2	37.0	48.0	93.0	4.0	31.5
BC158	UI-3	103	16.2	35.9	48.0	82.0	5.0	25.0
BC006	BelMiNeb-RMR-4	6	16.2	35.5	42.0	83.0	2.5	39.5
BC193	ABC-Weihing	119	15.7	38.9	42.0	86.0	3.0	40.5
BC137	Beryl R	33	15.5	33.3	41.0	86.0	4.0	30.5

EXPERIMENT 2112 MDP PANEL YIELD TRIAL (MEDIUM SEEDED)						PLANTED: 6/3/21		
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)
BC208	NE1-09-9	129	15.2	43.6	42.0	83.0	3.0	36.0
BC357	Gemini	63	15.0	31.3	41.0	86.0	3.5	33.0
BC008	BelMiNeb-RMR-8	2	14.9	34.2	42.0	85.0	3.0	38.5
BC017	Ouray	75	14.8	39.7	41.0	83.0	3.0	39.0
BC013	AC Polaris	7	14.7	40.2	40.0	88.0	4.0	31.5
BC166	UI-123	106	14.5	36.2	42.0	82.0	5.0	21.0
BC220	JM-24	134	14.4	37.0	42.0	82.0	4.0	28.0
BC244	Coulee	145	13.8	38.9	44.0	83.0	5.0	24.5
BC002	BelMiNeb-RMR-3	68	13.6	39.4	41.0	84.0	3.0	32.5
BC111	Buckskin	30	13.0	44.3	39.0	82.0	4.0	24.5
BC005	BelMiNeb-RMR-7	1	12.2	37.4	42.0	83.0	3.5	34.0
BC227	Pindak	138	11.6	37.4	43.0	81.0	4.5	24.5
BC211	Win Mor	132	11.6	43.5	40.0	86.0	4.5	32.0
BC238	USPT-ANT-1	143	11.4	38.5	48.0	88.0	4.5	29.0
BC184	BelMiNeb 5	114	11.2	36.0	41.0	85.0	3.0	38.0
BC021	Olathe	77	11.1	30.5	47.0	93.0	4.5	25.0
BC189	Tara	116	11.1	34.7	45.0	88.0	5.0	24.5
BC136	Beryl	99	9.9	32.2	41.0	88.0	4.0	30.5
MEAN (168)			21.5	37.5	42.7	83.4	3.8	31.5
LSD (.05)			4.0	0.9	2.0	2.6	0.6	7.0
CV%			11.3	1.5	2.8	1.9	10.0	13.5

EXPERIMENT 2113 MRPN/CDBN YIELD TRIAL								PLANTED: 6/3/21	
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
S18904	S14706/R13752, **CORAL**	21	38.0	38.3	44.0	83.0	1.3	49.7	6.0
I21913	PK9-15-4-B	14	36.7	42.2	41.0	82.0	2.3	47.3	4.3
G19611	G16346/G16318	16	36.3	38.2	42.0	84.0	2.0	49.3	4.3
G19613	G16351/P16902	17	36.2	43.2	43.0	84.0	2.0	51.3	5.3
I21903	ND171959	4	35.3	37.5	41.0	83.0	2.7	41.0	4.3
P19713	P16911/P16901	19	35.1	40.2	42.0	83.0	2.0	52.3	5.3
R17604	R12859/R12844	20	35.1	33.8	44.0	83.0	2.0	48.0	6.0
I21905	ND171703-SD	6	34.8	34.9	47.0	84.0	2.7	47.7	4.7
B18504	Zenith//Alpena*/B09197, **ADAMS**	32	34.4	22.6	44.0	83.0	1.7	45.0	6.0
P16901	Eldorado/P11519, **CHARRO**	7	33.9	40.7	44.0	83.0	2.0	46.7	6.0
I17519	ND131413	1	33.7	41.6	42.0	83.0	3.0	46.0	3.7
I21914	PK10-3-6-3	15	33.5	41.7	41.0	82.0	2.0	46.7	4.3
P19103	Eldorado*/Palomino//G13444 (SDP)	18	33.4	35.3	41.0	84.0	2.7	41.7	3.3
I20801	PT11-13-31, **USDA RATTLER**	28	33.0	43.0	42.0	83.0	1.7	49.3	6.0
I21909	NE2-20-3	10	32.6	41.1	41.0	84.0	3.0	47.3	3.3
I07113	PNE-6-94-75/Kodiak, **LAPAZ**	22	32.5	40.0	44.0	83.0	2.0	46.7	4.3
I21902	ND172568	3	31.6	43.8	42.0	83.0	2.7	44.3	4.0
R98026	R94037/R94161, **MERLOT**	24	30.9	37.7	42.0	83.0	3.0	43.3	3.3
I19717	GN16-7-3	27	30.0	39.0	42.0	83.0	2.0	45.3	5.0
I21915	PT9-5-6	30	29.1	41.1	42.0	83.0	2.0	46.0	4.7
I18623	PT16-9, **USDA DIAMONDBACK**	26	28.8	38.7	42.0	83.0	2.0	46.0	5.7
I18601	Matterhorn/NE94-75, ARIES	23	27.8	38.5	41.0	83.0	2.3	40.0	4.0
I17512	PT10-12-1	25	27.4	39.2	43.0	83.0	2.3	42.3	4.3
I17520	NDF140813	2	26.8	44.3	41.0	83.0	2.3	42.7	4.3
I84002	NW410//VICTOR/AURORA, **OTHELLO**	29	26.4	44.3	41.0	81.0	3.3	30.0	3.0
I21904	ND151077	5	26.2	45.5	41.0	83.0	1.7	46.0	4.0
I21907	NE1-20-31	8	26.2	43.4	41.0	83.0	2.3	46.3	4.3
I21912	GN16-13-1	13	24.5	37.4	42.0	83.0	2.7	38.3	3.7
I21916	NE1-20-21	31	23.8	45.2	40.0	83.0	3.0	44.0	3.0
I21908	NE1-20-19	9	23.4	40.6	41.0	83.0	2.0	46.0	4.3
I21911	NE2-20-14	12	21.0	41.7	40.0	82.0	3.0	34.0	3.0
I21910	NE2-20-12	11	20.9	43.1	41.0	82.0	3.3	35.0	3.0
MEAN (32)			30.6	39.9	42.1	83.0	2.3	44.6	4.4
LSD (.05)			3.9	1.3	1.2	0.6	0.6	4.2	0.6
CV%			9.4	1.9	2.1	0.5	17.6	7.0	10.6

EXPERIMENT 2114 DRY BEAN DROUGHT NURSERY YIELD TRIAL									PLANTED: 6/3/21
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
B18504	Zenith//Alpena*/B09197, **ADAMS**	13	39.7	20.8	43.0	83.0	1.0	47.0	6.0
G16351	Eldorado/G13467, **EIGER**	14	33.1	34.3	44.0	83.0	2.7	48.3	4.3
P16901	Eldorado/P11519, **CHARRO**	15	33.0	39.1	44.0	83.0	2.3	42.7	5.0
I21913	PK9-15-4-B	11	32.5	42.1	41.0	82.0	2.7	45.3	4.0
S18904	S14706/R13752, **CORAL**	16	31.8	38.2	42.0	83.0	2.0	47.3	5.0
I19717	GN16-7-3	9	29.7	38.7	42.0	83.0	2.0	43.3	4.3
I17512	PT10-12-1	8	28.8	34.0	43.0	83.0	2.7	40.7	4.0
I21914	PK10-3-6-3	12	27.2	40.4	41.0	81.0	2.7	38.7	4.0
I19742	NE4-18-63	18	27.0	41.7	41.0	83.0	3.0	37.0	4.0
I17537	SB2_89_9, 15F-13029	2	26.1	32.2	40.0	82.0	1.7	40.0	4.7
I05834	ND020351, **STAMPEDE**	24	25.7	40.3	43.0	82.0	2.7	37.7	4.0
I19743	NE2-18-22	19	24.3	36.7	42.0	85.0	2.7	42.0	3.7
I18606	NE1-17-36	17	23.6	38.1	41.0	82.0	3.0	35.7	3.3
I09151	**MARQUIS**	21	23.5	36.9	42.0	83.0	2.7	36.0	3.7
R98026	R94037/R94161, **MERLOT**	23	22.6	35.2	42.0	82.0	3.0	37.7	4.0
I21928	NE4-18-22	20	21.9	43.4	41.0	82.0	3.3	34.7	3.3
I16716	SB2_171, MATT/G21212///MATT/DOR	1	21.4	26.8	42.0	82.0	3.7	27.7	3.3
I21923	Matterhorn/PT7-2, SB3-144	3	20.6	36.5	41.0	82.0	3.7	31.0	2.7
I18623	PT16-9, **USDA DIAMONDBACK**	7	20.3	36.4	43.0	83.0	2.0	46.3	4.7
I21926	Tacana/Wax6//DPC 40, SB4-122	6	19.6	22.6	42.0	83.0	1.7	35.3	4.7
I21912	GN16-13-1	10	19.5	34.8	43.0	82.0	3.3	32.7	3.3
I21925	MIB 780/Matterhorn, SB3-315	5	18.7	37.3	42.0	82.0	3.0	30.7	3.0
G93414	**MATTERHORN**	22	13.8	37.1	40.0	82.0	4.0	27.7	2.3
I21924	INB 870/Matterhorn, SB3-289	4	11.5	26.7	42.0	82.0	4.0	28.3	2.7
MEAN (24)			24.8	35.4	41.9	82.5	2.7	38.1	3.9
LSD (.05)			3.0	1.0	1.5	0.7	0.6	3.9	0.6
CV%			8.8	1.5	2.7	0.6	16.1	7.5	10.9

EXPERIMENT 2115 STANDARD KIDNEY BEAN YIELD TRIAL						PLANTED: 6/9/21				
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	DES. SCORE	ROOT ROT (1-7)	WM (1-9)
K19831	K16638/K16980	2	38.5	62.6	45.0	94.0	2.3	4.3	4.1	3.7
K20745	K17703/K17816	28	37.0	57.9	42.0	93.0	1.7	4.7	4.0	3.3
K17702	K11714*/ISABELLA	4	36.9	62.9	45.0	94.0	2.0	4.3	4.3	3.3
K20221	K17206/K16136	44	36.1	53.7	45.0	93.0	2.7	4.0	4.5	4.0
K17703	K11714*/K13902	6	35.6	58.2	45.0	94.0	2.0	4.3	4.1	3.3
K20717	K16640/K17702	47	35.5	57.7	45.0	93.0	3.0	4.3	4.3	3.7
K19817	K15901/K16980	3	35.1	57.5	45.0	95.0	2.7	4.0	4.1	3.0
K15601	RED CEDAR/K11916, **COHO**	5	34.5	50.0	45.0	92.0	2.3	4.0	4.2	3.7
K19832	K16981/K16962	9	34.4	65.4	44.0	93.0	2.3	3.7	3.5	3.7
K20744	K17703/K17816	30	34.3	58.9	41.0	92.0	1.3	4.7	4.3	2.0
K20743	K17703/K17816	27	34.1	57.8	43.0	92.0	2.3	4.3	3.9	4.0
K20721	K16640/K17702	35	34.1	54.7	46.0	93.0	2.7	3.7	4.1	5.7
K20742	K17703/K17816	38	34.1	59.2	45.0	93.0	1.7	4.7	4.5	2.3
K20715	K16136/K16640	39	33.9	57.0	41.0	92.0	2.3	3.7	4.3	3.0
K19830	K16638/K16980	7	33.5	62.8	45.0	94.0	2.3	4.3	4.1	4.0
K20239	K16957/K17703	43	33.5	56.4	44.0	92.0	2.0	3.7	4.1	2.7
K20235	K16136/K11306	45	33.2	52.6	41.0	92.0	2.0	3.7	4.1	3.0
K20732	K17703/K17702	37	32.9	59.2	44.0	93.0	2.0	4.0	4.4	3.0
K20720	K16640/K17702	40	32.4	51.9	45.0	92.0	2.7	3.7	3.9	4.0
K20734	K15601/K16131	32	32.3	59.2	45.0	93.0	2.7	4.0	4.1	4.7
K20210	K16131/K11306	36	32.2	49.3	42.0	88.0	3.3	3.0	4.7	3.0
K20217	K17209/K17703	34	32.1	58.6	45.0	93.0	2.3	4.7	4.2	3.7
K16136	K12206/ND02-385-14	11	31.8	53.6	42.0	94.0	3.0	3.3	4.0	2.7
K20730	K17703/K17702	29	31.7	59.8	44.0	93.0	2.7	3.3	3.6	4.7
K19610	K16126/K11306	1	31.3	54.8	45.0	92.0	3.3	4.0	4.3	3.3
K17704	K11714*/K13902	15	31.2	59.5	45.0	93.0	3.0	3.3	3.9	3.7
K20212	K16131/K11306	31	30.7	59.5	41.0	90.0	1.7	4.0	4.4	1.3
K21907	K17816/K17702	54	29.2	48.8	43.0	93.0	3.0	3.7	4.3	3.0
I17507	ND122386, **ND WHITETAIL**	23	27.5	54.0	46.0	91.0	3.7	3.3	4.7	2.7
K20749	K16640/K17703	42	27.0	53.2	40.0	91.0	1.3	4.0	4.5	1.7

EXPERIMENT 2115 STANDARD KIDNEY BEAN YIELD TRIAL						PLANTED: 6/9/21				
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	DES. SCORE	ROOT ROT (1-7)	WM (1-9)
K11306	K06621/USDK-CBB-15, **RED CEDAR**	8	26.6	53.9	43.0	89.0	2.7	3.0	4.4	3.3
K16924	K11917/SNOWDON, **DENALI**	12	26.5	57.4	38.0	86.0	1.7	4.0	4.2	1.7
K21902	K15901/K17805	49	26.3	60.0	37.0	88.0	1.3	3.3	4.0	2.0
K19120	K16109/K16119	17	26.0	51.6	45.0	92.0	1.3	4.7	4.4	3.0
K21903	K16136/K17805	50	25.8	52.9	46.0	95.0	3.0	4.0	4.7	2.3
K21913	K15901/K17805	26	25.8	57.3	37.0	90.0	2.3	3.3	3.9	1.7
K20234	K16136/K11306	33	25.6	51.3	39.0	87.0	1.7	4.0	5.3	1.3
K21905	K17805/K15901	52	25.5	64.5	37.0	87.0	1.0	4.0	4.3	2.0
K90101	CHAR/2*MONT, **RED HAWK**	19	25.1	51.0	41.0	88.0	2.7	3.7	4.5	2.0
K21910	K17209/K16957	10	24.9	56.2	46.0	94.0	2.7	4.3	4.9	2.3
K90902	BEA/50B1807//LASSEN, **BELUGA**	21	24.6	54.6	46.0	93.0	2.7	3.7	4.4	2.7
I11201	**CLOUSEAU**	25	23.1	64.8	38.0	87.0	3.0	3.0	4.6	1.7
K20712	K16136/K16640	46	23.0	59.3	43.0	88.0	2.3	3.7	4.5	2.7
K74002	**MONTCALM**	24	23.0	58.3	42.0	93.0	1.3	3.7	4.7	2.3
K21912	K16957/K17816	13	22.9	46.4	45.0	89.0	3.0	3.3	4.5	3.0
K20728	K17703/K15901	41	22.5	51.4	45.0	92.0	2.3	3.7	3.9	4.0
K21906	K17805/K15901	53	22.1	64.1	36.0	87.0	1.3	3.7	4.3	2.0
K21911	K17206/K17816	14	21.5	46.8	45.0	90.0	3.7	3.0	4.9	3.0
K21909	K15901/K17816	56	20.2	45.3	45.0	88.0	2.7	3.7	4.2	2.3
K21908	K17816/K17702	55	20.0	44.1	46.0	90.0	2.3	4.0	4.5	2.0
I90013	**CELRK**	20	20.0	65.0	35.0	86.0	1.3	3.0	4.2	1.7
K21904	K17703/K17816	51	19.5	42.6	45.0	93.0	4.0	3.7	3.9	2.7
K18312	RED CEDAR/K14104	16	19.5	57.6	45.0	88.0	3.3	3.0	4.7	3.3
K21901	K16957/K17816	48	18.1	50.1	45.0	88.0	3.7	3.0	4.0	3.0
K08961	K04604/USDK-CBB-15, **SNOWDON**	18	17.0	68.4	34.0	86.0	1.0	3.3	4.3	1.3
K19608	K16640/K16638	22	16.8	49.4	46.0	89.0	3.3	3.0	4.5	2.3
MEAN (56)			28.4	55.9	42.9	91.1	2.4	3.8	4.3	2.9
LSD (.05)			3.5	1.5	1.6	1.8	1.0	0.8	0.9	1.3
CV%			9.1	1.6	2.7	1.4	31.4	15.4	14.9	34.2

EXPERIMENT 2116 STANDARD YELLOW BEAN YIELD TRIAL								PLANTED: 6/9/21	
NAME	**PEDIGREE**	**ENTRY**	**YIELD CWT /ACRE**	**100 SEED WT. (g)**	**DAYS TO FLOWER**	**DAYS TO MATURITY**	**LODGING (1-5)**	**DES. SCORE**	**WM (1-9)**
I14515	DBY-60-1, **PATRON**	18	25.8	42.9	43.0	92.0	3.3	3.3	3.3
Y19810	Y16507/Y16503	1	25.6	38.0	44.0	93.0	2.5	4.3	3.3
I17506	**SVS-0863**	10	25.5	39.9	44.0	92.0	3.5	3.0	2.5
Y19804	Y16503/Y16507	8	24.2	38.2	42.0	92.0	2.0	3.3	2.3
Y17502	Y11405/PR1146-123 (round)	5	23.9	40.7	39.0	90.0	2.5	3.8	2.5
Y19801	Y16503/Y16507	3	22.8	42.8	42.0	92.0	2.8	3.5	2.8
Y18703	X15305/X15302	4	22.7	40.7	41.0	91.0	2.3	4.3	2.5
Y19808	Y16503/X16908	9	21.9	45.3	42.0	92.0	2.5	3.5	3.5
Y19817	X16908/Y16507	6	21.8	42.5	44.0	87.0	2.3	3.8	2.8
Y19815	X16908/Y16507	7	21.6	44.2	45.0	90.0	3.0	4.0	2.5
I18649	ADP-37/Dolly (ADP-624), PIC86	15	21.5	71.2	44.0	93.0	3.8	3.0	3.3
Y16507	PR1146-123/Y11405, **YELLOWSTONE**	11	20.9	35.8	41.0	86.0	2.5	3.5	2.8
Y21101	Y16507/I17504	16	19.7	45.0	40.0	91.0	2.8	3.8	2.3
Y17604	Y11405*/UC Canario707	2	18.4	39.8	40.0	91.0	2.5	3.8	2.5
Y20903	Y16507/I17504	13	16.9	42.1	39.0	91.0	2.3	3.3	2.0
Y20917	K16957/I14515	12	14.7	37.4	39.0	87.0	2.3	3.5	2.3
Y21102	I17504/Y17502	17	14.6	39.2	38.0	89.0	2.3	3.8	2.0
Y20909	I17504/Y17502	14	7.6	36.9	39.0	89.0	1.5	3.0	2.3
MEAN (18)			20.6	42.4	41.4	90.3	2.6	3.6	2.6
LSD (.05)			2.7	0.8	1.8	2.0	0.7	0.6	0.8
CV%			11.1	1.0	3.8	1.9	21.5	14.5	25.6

EXPERIMENT 2117 NSI WHITE MOLD YIELD TRIAL									PLANTED: 6/9/21		
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE	WHITE MOLD (1-9)	WHITE MOLD (%)
R17602	R12845/R12859	133	33.7	38.6	46.0	90.0	2.3	41.0	3.3	5.7	63.0
B20599	B16506/B15430	15	32.1	24.0	45.0	90.0	2.0	50.0	4.0	5.7	63.0
N20352	N16405/G16301	59	30.3	27.7	46.0	91.0	2.3	47.0	3.3	5.7	63.0
B16504	Zenith//Alpena*/B09197	7	29.9	22.9	45.0	90.0	2.0	43.0	4.3	4.3	48.1
B21713	B16501/B16504	119	28.5	24.2	46.0	92.0	2.3	34.7	3.7	6.0	66.7
I09203	**SR9-5**	173	28.3	29.5	48.0	93.0	3.3	41.3	3.0	6.0	66.7
R20684	I13401/R17605	157	27.9	28.3	46.0	92.0	3.7	35.7	3.0	7.7	85.2
B21706	B15430/B16504	112	27.8	21.9	46.0	93.0	2.3	38.0	3.0	5.7	63.0
B20536	B15430/B16504	27	27.3	21.6	45.0	91.0	2.0	44.7	4.0	5.0	55.6
R17605	R12859/R12844	134	27.1	34.8	46.0	90.0	2.7	47.0	3.3	6.7	74.1
B20532	B15430/B16504	21	27.0	23.4	45.0	92.0	2.0	36.3	4.3	5.0	55.6
B20590	B16505/B16504	31	26.8	21.4	45.0	93.0	1.7	43.3	4.7	4.3	48.1
N21511	N15306/N15337	82	26.7	19.6	46.0	92.0	2.3	41.3	4.3	2.7	29.6
R20639	R17605/R16503	146	25.8	34.2	46.0	91.0	3.0	41.7	3.0	5.7	63.0
S08418	S02754/S04503, **ROSETTA**	136	25.6	36.3	47.0	93.0	3.0	37.3	3.7	3.3	37.0
R20629	R17605/R16503	161	25.5	36.1	46.0	90.0	2.7	41.7	3.0	5.3	59.3
R20633	R17605/R16503	149	25.5	30.3	46.0	90.0	3.0	42.0	3.0	6.7	74.1
R20653	I13401/R17603	154	25.5	32.6	48.0	92.0	3.7	39.0	3.0	8.3	92.6
B19309	B15414/B16504	1	25.2	22.3	46.0	90.0	2.0	55.7	4.0	6.0	66.7
R18402	R12859/R12844	140	25.0	36.8	47.0	94.0	2.3	39.0	3.0	5.0	55.6
R20669	I13401/R17603	151	25.0	28.1	47.0	90.0	3.0	39.0	3.3	6.0	66.7
B20602	B16506/B16504	20	24.9	19.8	44.0	89.0	1.3	46.0	3.7	5.0	55.6
R20604	R12844/I13401	153	24.8	32.0	49.0	95.0	4.0	33.0	3.0	8.0	88.9
R20627	R17605/R16503	143	24.3	33.2	48.0	90.0	2.3	45.7	3.0	6.3	70.4
I08933	37-2, **USPT-WM-12**	172	24.3	43.0	46.0	89.0	3.0	41.7	3.0	6.0	66.7
B20591	B16505/B16504	16	24.3	22.2	45.0	92.0	2.7	44.0	3.7	6.3	70.4
B21712	B16501/B16504	118	24.1	20.2	46.0	89.0	2.0	44.7	4.0	6.3	70.4
R20683	I13401/R17605	152	24.0	34.5	47.0	92.0	3.0	39.0	3.0	6.3	70.4
R20624	R17605/R16503	156	23.9	32.6	48.0	90.0	3.7	43.0	3.0	7.7	85.2
B21723	B17730/B16504	129	23.8	21.1	45.0	90.0	1.7	42.3	4.0	6.7	74.1
B20642	B17730/B16504	22	23.8	21.8	47.0	92.0	1.7	41.3	4.3	4.3	48.1
N21515	N15306/N17504	86	23.8	17.2	47.0	92.0	2.3	41.3	3.7	5.3	59.3
B18504	Zenith//Alpena*/B09197, **ADAMS**	2	23.2	20.0	45.0	88.0	2.3	43.3	3.7	6.0	66.7
R20636	R17605/R16503	162	23.1	33.7	47.0	90.0	3.0	46.3	3.0	6.7	74.1
B20623	B17523/B16504	35	22.8	18.7	46.0	90.0	2.3	41.0	3.7	6.7	74.1

EXPERIMENT 2117 NSI WHITE MOLD YIELD TRIAL									PLANTED: 6/9/21		
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE	WHITE MOLD (1-9)	WHITE MOLD (%)
N19277	N14229/N14218	43	22.7	19.5	46.0	94.0	2.7	37.3	3.7	3.7	40.7
B18204	B10244/B15430	168	22.7	24.3	44.0	90.0	1.7	46.7	4.0	5.3	59.3
B20632	B17692/B16504	30	22.5	21.6	45.0	90.0	2.0	39.0	4.0	6.0	66.7
R20614	R17604/I13401	163	22.5	34.8	47.0	92.0	3.0	39.7	3.0	6.7	74.1
B10244	B04644/ZORRO, **ZENITH**	5	22.4	22.7	45.0	89.0	2.0	44.7	3.7	6.7	74.1
R20637	R17605/R16503	148	22.4	30.6	46.0	89.0	2.3	40.3	3.0	6.3	70.4
R20625	R17605/R16503	150	22.3	30.1	48.0	90.0	3.0	46.0	3.0	7.3	81.5
B21715	B16501/B16504	121	22.2	21.3	45.0	90.0	1.7	41.3	4.3	5.3	59.3
B21708	B15430/B16504	114	22.2	24.4	46.0	90.0	2.0	44.3	4.0	5.7	63.0
R17604	R12859/R12844	137	22.2	31.5	48.0	92.0	3.7	35.0	3.0	5.3	59.3
B20538	B15430/B16504	33	21.8	24.3	45.0	89.0	2.0	45.3	4.3	5.7	63.0
R20612	R17603/I17551	159	21.6	36.4	47.0	93.0	3.7	31.0	3.0	7.0	77.8
N19290	N13142/B14302	44	21.6	21.3	47.0	93.0	3.7	40.7	3.0	6.7	74.1
B19339	B16507/B15453	11	21.5	23.9	46.0	91.0	2.0	44.3	3.7	5.7	63.0
N21501	N14218/N15306	72	21.5	16.5	47.0	93.0	3.3	38.7	3.0	8.3	92.6
R20635	R17605/R16503	158	21.4	30.8	46.0	90.0	3.3	47.7	3.0	7.7	85.2
S20405	S17702/R17604	164	21.2	36.4	49.0	94.0	3.0	37.7	3.0	5.3	59.3
I17501	Jaguar/BL05222, **BLACK BEAR**	8	21.2	22.5	46.0	89.0	1.7	47.7	4.0	6.7	74.1
B20547	B16501/B16504	18	21.2	21.6	46.0	89.0	1.3	39.0	4.0	4.7	51.8
N21509	N14229/B16504	80	21.1	17.8	48.0	93.0	2.7	45.3	3.0	5.7	63.0
N20391	B16504/N14218	64	21.1	19.4	47.0	94.0	2.7	43.3	3.3	5.7	63.0
B20597	B16506/B15430	17	21.0	23.1	46.0	89.0	2.3	41.0	3.7	6.0	66.7
B19345	B16506/B16507	6	21.0	22.9	45.0	90.0	2.0	47.7	4.0	5.7	63.0
B21720	B16505/B16504	126	20.8	21.3	44.0	91.0	2.0	40.3	4.0	5.7	63.0
B21714	B16501/B16504	120	20.7	19.8	45.0	89.0	1.7	45.0	4.0	5.7	63.0
N20405	B17523/B16504	65	20.7	20.6	46.0	93.0	2.0	38.3	3.7	5.0	55.6
B21709	B15430/N14229	115	20.7	19.5	46.0	89.0	1.7	42.0	3.7	5.7	63.0
I11264	COOP 03019, **MERLIN**	55	20.4	17.2	45.0	90.0	2.7	47.0	3.0	7.3	81.5
R12844	SR9-5/R09508, **CAYENNE**	139	20.4	33.9	47.0	91.0	3.0	41.3	3.0	7.3	81.5
R20659	I13401/R17603	147	20.4	27.4	47.0	94.0	3.3	36.0	3.3	6.0	66.7
N21514	N15306/N17504	85	20.3	17.8	46.0	93.0	2.0	43.7	3.7	3.7	40.7
N19253	N15335/N14243	54	20.3	17.5	47.0	92.0	2.3	46.3	3.7	5.3	59.3
B21718	B16504/B17523	124	20.1	17.4	45.0	88.0	1.7	44.0	4.0	6.0	66.7
R20667	I13401/R17603	144	20.1	34.0	48.0	90.0	3.0	37.0	3.3	5.3	59.3
B21717	B16504/B17106	123	20.0	20.4	48.0	90.0	2.3	42.7	3.7	6.7	74.1

EXPERIMENT 2117 NSI WHITE MOLD YIELD TRIAL									PLANTED: 6/9/21		
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE	WHITE MOLD (1-9)	WHITE MOLD (%)
N18103	N13120/PR00806-81	48	20.0	21.7	46.0	91.0	2.0	44.0	3.7	3.7	40.7
B21704	N17504/B15430	110	20.0	22.8	45.0	89.0	3.0	39.0	3.0	7.7	85.2
B16501	Zenith/B10215	166	19.9	20.8	45.0	87.0	1.7	44.3	4.0	5.0	55.6
S18904	S14706/R13752, **CORAL**	131	19.7	41.5	46.0	91.0	2.3	42.0	3.7	6.3	70.4
N21507	N14229/B14302	78	19.6	19.5	46.0	91.0	2.3	43.0	4.0	5.7	63.0
B21701	N14218/B16504	107	19.6	19.4	46.0	89.0	3.0	42.3	3.3	7.7	85.2
N17505	N14230/N12447	167	19.5	20.9	47.0	93.0	2.3	39.3	3.3	6.3	70.4
R20632	R17605/R16503	160	19.4	36.5	47.0	90.0	3.3	38.7	3.0	6.3	70.4
B21724	B17996/B17540	130	19.4	20.7	45.0	89.0	2.3	44.3	3.3	5.7	63.0
N20404	B16505/N17504	58	19.3	21.5	44.0	92.0	2.0	37.3	3.7	4.0	44.4
B21702	N14229/B16504	108	19.3	22.8	45.0	92.0	2.7	43.0	4.0	6.0	66.7
R98026	R94037/R94161, **MERLOT**	142	19.2	36.1	46.0	88.0	3.7	38.7	3.0	8.3	92.6
N21535	G16339/N17506	106	19.1	18.9	47.0	91.0	3.3	50.3	3.0	8.0	88.9
B19341	B16507/B16501	12	19.1	21.0	45.0	89.0	2.0	43.7	3.0	6.7	74.1
B20579	B16504/B17259	37	18.9	22.1	44.0	88.0	1.7	43.3	3.7	6.7	74.1
N21517	N16405/G17923	88	18.9	19.1	48.0	93.0	3.0	46.7	3.7	6.3	70.4
N20336	N15306/N14218	61	18.9	17.0	47.0	93.0	3.3	42.0	3.0	7.0	77.8
B21705	B14302/B15430	111	18.7	21.9	48.0	94.0	2.3	43.0	4.0	5.7	63.0
B21707	B15430/B16504	113	18.7	22.6	46.0	90.0	2.3	43.3	3.7	5.3	59.3
N20401	B16505/N17504	63	18.6	18.3	49.0	93.0	3.0	36.7	3.3	5.3	59.3
N21502	N14218/N15306	73	18.6	16.6	47.0	91.0	3.0	37.0	3.0	5.7	63.0
R19502	R16519/R16518	141	18.5	31.7	46.0	90.0	2.7	43.0	3.0	7.0	77.8
B04554	B00103*/X00822, **ZORRO**	10	18.5	21.6	47.0	89.0	1.7	34.0	4.3	5.0	55.6
N19246	N15331/N16405	40	18.4	18.5	45.0	89.0	3.0	45.0	3.3	6.7	74.1
N20395	B16504/N17504	60	18.4	20.6	45.0	92.0	2.3	41.0	3.7	6.7	74.1
N21533	G16339/N17506	104	18.3	26.3	46.0	91.0	2.3	42.0	3.3	5.7	63.0
N18105	N13131/N14201	46	18.1	18.7	48.0	93.0	2.7	40.7	3.7	5.7	63.0
S19307	X16804/S16804	132	18.0	34.1	45.0	89.0	1.3	41.3	3.7	5.0	55.6
N19284	G14505/X16708	52	17.9	19.3	48.0	90.0	3.0	44.0	3.3	7.0	77.8
N21530	N14229/N17506	101	17.9	18.3	44.0	89.0	2.3	40.3	3.3	6.7	74.1
N21513	N15306/N16405	84	17.6	17.5	45.0	92.0	3.0	38.7	3.0	8.3	92.6
N21505	N14229/N17504	76	17.6	16.5	45.0	91.0	2.0	47.7	3.3	5.3	59.3
B21719	B16504/N17504	125	17.6	20.2	43.0	90.0	2.7	46.0	3.7	6.7	74.1
R20642	I13401/R12844	155	17.6	29.6	46.0	91.0	3.0	35.0	3.0	8.3	92.6
I13401	SR99238/Merlot, **VIPER**	138	17.2	29.1	45.0	90.0	4.0	26.7	3.0	8.3	92.6

EXPERIMENT 2117 NSI WHITE MOLD YIELD TRIAL									PLANTED: 6/9/21		
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE	WHITE MOLD (1-9)	WHITE MOLD (%)
B21722	B17692/B16504	128	17.1	19.8	45.0	88.0	1.7	37.0	3.3	6.7	74.1
B19332	B16501/B15464	14	17.0	22.3	47.0	89.0	2.3	42.3	3.7	7.0	77.8
N21525	N17506/N14229	96	16.8	17.7	47.0	90.0	2.0	45.3	3.7	6.0	66.7
B21721	B17523/B16504	127	16.8	17.7	46.0	89.0	2.0	44.3	3.7	6.0	66.7
BC269	I9365-25	170	16.7	23.1	47.0	92.0	3.7	28.3	3.0	6.0	66.7
N18122	N15334/N15335	47	16.7	20.5	46.0	92.0	2.3	46.7	4.0	6.7	74.1
B19344	B16506/B16507	3	16.6	19.8	44.0	90.0	2.3	43.7	3.0	7.3	81.5
N21526	N17506/N14229	97	16.5	17.0	45.0	90.0	2.3	35.0	3.7	5.7	63.0
B21703	N16405/B15430	109	16.4	19.6	45.0	88.0	2.3	42.3	4.0	6.0	66.7
B20527	B14302/B15430	28	16.4	20.7	45.0	92.0	2.7	38.7	3.3	6.3	70.4
N20335	N14229/G14503	62	16.3	15.5	46.0	91.0	2.3	42.0	4.0	5.7	63.0
R20652	I13401/R12844	145	16.2	31.9	47.0	90.0	3.7	39.7	3.3	7.7	85.2
B20639	B17730/B15430	34	16.0	19.9	45.0	87.0	2.0	44.7	3.7	6.3	70.4
B20616	B17106/B17259	38	16.0	19.9	45.0	89.0	1.7	47.0	5.0	5.3	59.3
N19285	G14505/X16708	45	15.9	23.0	48.0	93.0	3.0	37.3	3.0	5.7	63.0
N20384	N14229/N17506	70	15.9	18.4	46.0	90.0	2.3	33.3	3.7	4.3	48.1
N21521	N17504/N14229	92	15.9	18.2	46.0	93.0	2.3	39.3	3.3	4.0	44.4
N21518	N16405/G17923	89	15.8	18.2	46.0	91.0	2.0	43.7	3.7	6.0	66.7
N21534	G16339/N17506	105	15.8	23.0	46.0	90.0	2.0	36.7	3.3	4.7	51.8
N21524	N17504/B17106	95	15.8	17.1	47.0	91.0	2.7	42.3	3.3	5.3	59.3
N20346	N16405/N15337	68	15.5	19.0	45.0	89.0	3.3	47.7	3.0	7.3	81.5
N21531	B15430/N14229	102	15.4	17.2	46.0	92.0	2.0	41.0	4.7	4.7	51.8
B19340	B16507/B15453	9	15.4	24.9	46.0	89.0	2.0	40.3	4.0	6.0	66.7
B20582	B16504/B17523	29	15.4	17.9	45.0	89.0	2.7	42.0	3.3	7.0	77.8
I81010	JAPON3/MAGDALENE, **BUNSI**	174	15.1	19.1	40.0	92.0	3.3	35.0	3.0	4.7	51.8
N21512	N15306/N16405	83	15.1	17.7	46.0	89.0	2.7	43.3	3.7	6.3	70.4
N21527	N17506/N16405	98	15.1	17.6	45.0	89.0	2.7	45.7	3.3	7.0	77.8
N21522	N17504/B15430	93	15.1	17.1	47.0	93.0	3.0	45.3	3.7	5.3	59.3
BC216	I9365-31	171	15.0	22.8	48.0	90.0	4.7	31.7	1.7	8.7	96.3
N18130	N15341/N14238	50	14.9	18.6	48.0	91.0	2.7	43.0	3.0	7.3	81.5
N19223	N14230/N16405	51	14.6	16.7	48.0	93.0	3.3	42.7	3.3	5.7	63.0
N20341	N15337/N16405	69	14.4	18.1	47.0	93.0	2.7	38.7	3.3	6.0	66.7
B20629	B17692/B16504	25	14.3	19.6	45.0	89.0	1.7	42.7	3.7	7.0	77.8
N21520	N17504/N14229	91	14.3	16.5	48.0	89.0	2.0	38.7	3.3	4.3	48.1
N20317	N14218/N17504	71	14.3	18.1	47.0	89.0	2.0	39.7	4.0	5.0	55.6

EXPERIMENT 2117 NSI WHITE MOLD YIELD TRIAL									PLANTED: 6/9/21		
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE	WHITE MOLD (1-9)	WHITE MOLD (%)
S18907	S14706/R13752	135	14.3	37.2	46.0	90.0	2.7	40.3	3.0	7.0	77.8
N20388	B15430/N14229	57	14.3	20.8	47.0	91.0	2.0	41.7	4.0	6.7	74.1
N21516	N16405/N15337	87	14.2	17.7	47.0	92.0	3.3	36.7	3.3	7.7	85.2
N21529	N17506/B15430	100	14.2	21.9	46.0	90.0	2.0	39.0	3.7	4.0	44.4
N21508	N14229/B14302	79	14.1	17.8	46.0	93.0	3.3	37.0	3.0	8.0	88.9
S20420	S17702/I13427	165	14.1	35.3	47.0	93.0	4.0	32.7	3.0	9.0	100.0
B20549	B16501/B16504	19	13.9	20.9	46.0	87.0	2.0	38.0	4.0	6.3	70.4
B19302	N16405/B16504	169	13.6	20.0	45.0	86.0	1.3	43.3	4.0	7.0	77.8
N21506	N14229/N17504	77	13.6	19.3	46.0	92.0	2.0	37.7	3.7	5.0	55.6
N19252	N15335/N14243	53	13.5	19.7	45.0	89.0	2.3	43.0	3.0	5.7	63.0
B19330	B16501/B15414	4	13.5	19.1	46.0	88.0	2.0	42.0	3.3	6.0	66.7
N19243	N15331/N16405	42	13.2	19.3	47.0	90.0	2.3	47.0	3.3	7.3	81.5
N21503	N14218/N17504	74	13.1	16.5	46.0	92.0	2.7	47.0	3.3	4.7	51.8
N21528	N17506/B15430	99	13.0	19.4	47.0	91.0	2.0	38.0	3.3	4.3	48.1
N21504	N14218/N17504	75	12.8	17.0	46.0	91.0	2.3	42.7	3.7	6.0	66.7
B20542	B16501/B15430	26	12.8	21.3	45.0	89.0	1.3	40.3	4.0	5.0	55.6
I96417	**G122**	176	12.5	36.4	46.0	93.0	3.7	35.3	3.0	7.0	77.8
B21716	B16504/B17106	122	12.5	20.7	46.0	88.0	2.3	39.0	3.7	5.7	63.0
B20627	B17540/N14218	36	12.4	19.2	46.0	88.0	1.7	40.0	3.7	5.3	59.3
B20621	B17106/N14218	32	12.3	24.3	45.0	85.0	2.0	41.0	4.0	7.0	77.8
N20376	N17506/N16405	67	12.3	17.5	46.0	92.0	3.0	43.3	3.3	7.7	85.2
N20343	N15337/N16405	66	12.2	17.0	46.0	91.0	3.0	44.0	3.0	6.7	74.1
N19226	N14243/N15326	39	12.1	17.1	48.0	93.0	3.0	37.7	3.0	4.3	48.1
B20617	B17106/N14218	23	12.1	18.9	46.0	89.0	2.3	38.7	3.7	6.7	74.1
B20620	B17106/N14218	24	11.9	19.2	46.0	86.0	1.7	47.0	3.7	7.3	81.5
N19239	N15331/N16404	41	11.5	18.8	47.0	92.0	2.3	42.7	3.7	5.7	63.0
N21523	N17504/B15430	94	11.5	19.7	47.0	91.0	3.3	38.0	3.0	7.3	81.5
N21510	N15306/N14229	81	11.4	19.9	45.0	91.0	2.3	41.3	3.0	6.0	66.7
N11283	MEDALIST/N08003, **ALPENA**	56	11.1	15.5	47.0	93.0	3.3	42.7	3.3	6.3	70.4
N19269	B15453/N14243	49	11.1	16.9	46.0	92.0	3.0	44.0	3.0	7.3	81.5
N21519	N17504/N14229	90	10.5	16.4	47.0	92.0	2.0	42.3	3.7	3.7	40.7
B21710	B16501/B15430	116	10.5	20.0	45.0	89.0	2.0	40.7	3.3	6.3	70.4
N21532	B16504/B11519	103	9.0	16.5	47.0	89.0	2.3	42.3	4.0	6.0	66.7
B18236	B14303/B12724	13	8.5	21.4	45.0	89.0	2.3	47.7	3.0	7.0	77.8
I89011	**BERYL**	175	8.2	34.0	40.0	86.0	5.0	26.7	1.3	9.0	100.0

EXPERIMENT 2117 NSI WHITE MOLD YIELD TRIAL										PLANTED: 6/9/21	
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE	WHITE MOLD (1-9)	WHITE MOLD (%)
B21711	B16501/B15430	117	7.8	23.4	46.0	88.0	1.7	45.0	4.0	6.7	74.1
MEAN (176)			18.8	23.0	46.1	90.6	2.5	41.4	3.5	6.1	67.8
LSD (.05)			3.8	0.7	1.8	2.0	0.8	7.3	0.8	1.9	20.6
CV%			14.9	1.9	2.8	1.6	24.8	13.1	17.0	22.5	22.5

EXPERIMENT 2118 NATIONAL WHITE MOLD YIELD TRIAL								PLANTED: 6/9/21	
NAME	**PEDIGREE**	**ENTRY**	**YIELD CWT /ACRE**	**100 SEED WT. (g)**	**DAYS TO FLOWER**	**DAYS TO MATURITY**	**DES. SCORE**	**WHITE MOLD (1-9)**	**WHITE MOLD (%)**
G19611	G16346/G16318	13	24.9	37.9	47.0	95.0	4.3	5.7	63.0
I09203	SR9-5	6	23.0	31.1	46.0	95.0	3.0	5.0	55.6
I18606	NE1-17-36	12	22.0	39.3	43.0	90.0	3.0	5.7	63.0
B19309	B15414/B16504	9	21.5	19.7	49.0	94.0	4.0	5.3	59.3
I21902	ND172568	5	20.4	38.2	47.0	93.0	3.0	7.0	77.8
P16901	Eldorado/P11519, **CHARRO**	16	19.4	38.6	48.0	90.0	4.0	6.7	74.1
P19713	P16911/P16901	15	18.8	30.3	45.0	89.0	3.7	5.0	55.6
S18904	S14706/R13752	10	17.6	36.5	49.0	94.0	3.7	6.7	74.1
I81010	JAPON3/MAGDALENE, **BUNSI**	3	14.5	18.6	43.0	93.0	3.0	5.0	55.6
I21929	SR16-1	7	14.1	37.3	50.0	95.0	3.0	5.7	63.0
G19613	G16351/P16902	14	13.9	35.1	46.0	88.0	3.3	7.0	77.8
I96417	**G122**	1	11.7	38.2	48.0	96.0	3.0	3.0	33.3
I20816	**ND132162, ND POLAR**	4	9.6	16.6	50.0	92.0	3.7	5.3	59.3
I19719	SR16-2	8	9.1	28.7	50.0	87.0	3.0	8.0	88.9
N19246	N15331/N16405	11	9.0	17.9	48.0	94.0	3.0	3.3	37.0
I89011	**BERYL**	2	7.8	33.2	43.0	87.0	2.0	8.7	96.3
MEAN (16)			16.1	31.1	47.1	92.0	3.3	5.8	64.6
LSD (.05)			2.1	1.1	2.6	2.7	0.5	1.5	16.1
CV%			9.2	2.1	3.9	2.1	9.9	18.0	18.0

EXPERIMENT 2119 STANDARD BLACK BEAN YIELD TRIAL (RUTH)									PLANTED: 6/11/21
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
B20536	B15430/B16504	30	44.5	22.2	47.0	90.0	1.0	52.0	5.5
B20547	B16501/B16504	21	43.2	20.9	47.0	90.0	1.0	47.0	4.5
B20599	B16506/B15430	18	42.7	21.1	47.0	89.0	1.0	53.0	5.0
B20591	B16505/B16504	19	41.6	21.1	47.0	92.0	1.0	52.0	4.5
B20590	B16505/B16504	34	41.1	19.0	47.0	91.0	1.0	52.0	4.0
B20642	B17730/B16504	25	39.4	19.3	46.0	90.0	1.0	49.5	5.0
B10244	B04644/ZORRO, **ZENITH**	5	38.6	22.1	47.0	92.0	2.0	45.5	5.5
B19309	B15414/B16504	1	38.1	19.4	47.0	89.0	1.0	47.5	5.0
B18504	Zenith//Alpena*/B09197, **ADAMS**	2	38.0	20.5	47.0	93.0	2.0	50.0	4.0
B20579	B16504/B17259	40	37.8	19.5	45.0	89.0	1.5	52.0	4.0
B20532	B15430/B16504	24	37.5	21.5	48.0	90.0	1.0	47.5	4.0
B20602	B16506/B16504	23	36.6	24.0	46.0	89.0	1.0	42.5	4.5
B16504	Zenith//Alpena*/B09197	7	35.7	18.7	46.0	94.0	2.5	45.5	3.5
B20527	B14302/B15430	31	35.5	20.1	47.0	92.0	2.0	45.0	4.0
B04554	B00103*/X00822, **ZORRO**	10	34.6	20.3	47.0	90.0	1.5	50.0	4.0
B19340	B16507/B15453	9	34.5	23.6	48.0	89.0	1.0	44.5	4.0
B20538	B15430/B16504	36	34.4	22.2	47.0	93.0	2.0	48.5	4.0
B19332	B16501/B15464	15	34.2	18.6	46.0	90.0	2.0	45.0	4.0
B18236	B14303/B12724	14	34.0	18.4	47.0	91.0	1.0	44.5	4.0
B20632	B17692/B16504	33	33.6	19.0	48.0	90.0	1.0	53.5	4.0
B19330	B16501/B15414	4	33.3	21.3	47.0	91.0	1.5	44.5	4.0
B20582	B16504/B17523	32	33.3	17.8	47.0	88.0	1.5	47.0	3.5
B19344	B16506/B16507	3	32.7	19.4	47.0	92.0	1.5	51.5	4.0
B20597	B16506/B15430	20	32.7	19.4	47.0	90.0	2.0	49.0	4.5
B20623	B17523/B16504	38	32.3	17.7	47.0	89.0	1.5	45.0	4.0
B19341	B16507/B16501	13	32.2	20.6	46.0	89.0	1.0	43.0	4.0
I21901	BL14500, **NIMBUS**	17	31.8	20.2	48.0	90.0	1.0	49.0	4.5
B20629	B17692/B16504	28	31.4	18.4	48.0	92.0	1.5	55.5	4.0
B20616	B17106/B17259	41	31.2	18.4	46.0	90.0	1.0	46.5	5.0
I03390	ND9902621-2, **ECLIPSE**	12	31.1	18.4	45.0	86.0	2.5	42.5	3.5

EXPERIMENT 2119 STANDARD BLACK BEAN YIELD TRIAL (RUTH)									PLANTED: 6/11/21
NAME	PEDIGREE	ENTRY	YIELD CWT /ACRE	100 SEED WT. (g)	DAYS TO FLOWER	DAYS TO MATURITY	LODGING (1-5)	HEIGHT (cm)	DES. SCORE
B19339	B16507/B15453	11	31.0	20.5	47.0	90.0	1.0	46.5	4.0
B20542	B16501/B15430	29	30.8	21.1	46.0	90.0	1.5	47.0	4.5
B19345	B16506/B16507	6	30.3	19.0	46.0	90.0	1.5	48.5	4.0
I17501	Jaguar/BL05222, **BLACK BEAR**	8	29.9	19.0	46.0	92.0	2.0	47.5	3.5
B20620	B17106/N14218	27	29.2	16.6	47.0	89.0	1.0	39.0	3.5
B20617	B17106/N14218	26	29.1	18.0	46.0	90.0	1.0	46.5	4.0
I19701	NDF120287, **ND TWILIGHT**	42	28.2	21.1	47.0	87.0	2.0	38.0	3.5
B20549	B16501/B16504	22	27.9	21.1	45.0	89.0	1.0	45.5	4.0
I19703	BL14506, **BLACK BEARD**	16	27.5	21.3	48.0	93.0	2.0	50.5	3.0
B20621	B17106/N14218	35	27.0	17.0	47.0	89.0	1.5	46.5	4.0
B20639	B17730/B15430	37	25.7	18.8	47.0	89.0	2.5	51.5	3.5
B20627	B17540/N14218	39	25.7	19.7	45.0	90.0	1.5	43.5	4.0
MEAN (42)			33.8	19.9	46.4	90.0	1.5	47.4	4.1
LSD (.05)			4.9	0.2	1.7	3.3	1.1	6.7	1.0
CV%			8.6	0.6	2.2	2.2	43.9	8.4	14.2

USDA-ARS Dry Bean Breeding Progress: Black, Cranberry, Kidney and Yellow Classes

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Black Bean Trials: Two black bean trials were planted at the Saginaw Valley Research Farm and Extension Center in Richville, MI on June 1, 2021. The advanced yield trial consisted of 21 entries and 4 check varieties. The preliminary yield trial consisted of 7 entries (Table 1).The trials were planted in 4 row plots 20 ft. long with 22 inch spacing between rows. Both trials consisted of three field replications per entry in a randomized complete block design. Beans were harvested on September 1, 2021 by direct harvesting the center 15 ft. of the center two rows with a Hege plot thresher. Seed yields ranged from 9.9 to 26.9 CWT/acre with an average of 19.2 CWT/acre for the advanced yield trial and 12.5 to 20.3 CWT/acre with an average of 16.4 CWT/acre for the preliminary yield trial (Table 1).

Cranberry Bean Trials: Two cranberry bean trials were planted at the Montcalm Research Farm in Entrican, MI on June 10, 2021. The advanced yield trial consisted of 21 entries and 3 check varieties with three replications of each entry. The preliminary yield trial consisted of 33 entries with two replications of each entry (Table 2). The trials were planted in 4 row plots 20 ft. long with 22 inch spacing between rows. The advanced yield trial was harvested on September 27, 2021 and the preliminary yield trial was harvested on September 28, 2021. For both trials the center 15 ft. of the center two rows were windrowed prior to threshing with a Hege plot thresher. Seed yields ranged from 7.0 to 29.4 CWT/acre with an average of 20.1 CWT/acre for the advanced yield trial and 1.7 to 29.3 CWT/acre with an average of 16.7 CWT/acre for the preliminary yield trial (Table 2). Some of the entries had very low yields (less than 10 CWT/acre) due to poor germination and stand establishment. The poor stands were likely caused by a heavy rainfall and subsequent high root rot pressure in the field early in plant development.

Kidney Bean Trials: Two kidney bean trials were planted at the Montcalm Research Farm in Entrican, MI on June 10, 2021. The advanced yield trial consisted of 12 entries and 4 check varieties with three replications of each entry. The preliminary yield trial consisted of 15 entries with two replications of each entry (Table 3). The trials were planted in 4 row plots 20 ft. long with 22 inch spacing between rows. The advanced yield trial was harvested on September 27, 2021 and the preliminary yield trial was harvested on September 28, 2021. For both trials the center 15 ft. of the center two rows were

windrowed prior to threshing with a Hege plot thresher. Seed yields ranged from 19.2 to 25.4 CWT/acre with an average of 22.6 CWT/acre for the advanced yield trial and 5.3 to 25.2 CWT/acre with an average of 15.1 CWT/acre for the preliminary yield trial (Table 3).

Yellow Bean Trials: Two yellow bean trials were planted at the Montcalm Research Farm in Entrican, MI on June 10, 2021. The advanced yield trial consisted of 20 entries and 4 check varieties with three replications of each entry. The preliminary yield trial consisted of 26 entries with one replication of each entry (Table 4). The trials were planted in 4 row plots 20 ft. long with 22 inch spacing between rows. The advanced yield trial was harvested on September 27, 2021 and the preliminary yield trial was harvested on September 28, 2021. For both trials the center 15 ft. of the center two rows were windrowed prior to threshing with a Hege plot thresher. Seed yields ranged from 8.0 to 22.0 CWT/acre with an average of 14.9 CWT/acre for the advanced yield trial and 2.1 to 16.4 CWT/acre with an average of 8.6 CWT/acre for the preliminary yield trial (Table 4). As with the cranberry trial, many of the yellow entries had very low yields (less than 10 CWT/acre), especially in the yellow preliminary trial. This was due to poor germination and stand establishment. The poor stands were likely caused by a heavy rainfall and subsequent high root rot pressure in the field early in plant development.

Table 1. USDA-ARS 2021 Black Bean Advanced and Preliminary Yield Trials at the Saginaw Valley Research Farm in Richville, Michigan

Expt.	Genotype	Pedigree	Flowering	Maturity	Lodging[1]	Plant Desirability[2]	Plant Height	Seed Wt.	Seed Yield
			dap	dap	(1-5)	(1-9)	inches	g/100 seeds	CWT
BLK-AY	BL1726-6	B1402_46_101\Lpa-02(06)	43	84	1.7	2.0	17.3	19.0	26.9
BLK-AY	BL1803-1-1	B1402-15\LPA9(29)M	43	84	1.0	2.7	17.0	18.4	24.6
BLK-AY	BL1726-1	B1402_46_101\Lpa-02(06)	43	84	1.7	3.0	17.0	19.2	23.1
BLK-AY	BL1726-2	B1402_46_101\Lpa-02(06)	43	84	1.3	2.3	18.5	18.4	22.9
BLK-AY	BL1801-2-1	B1403-19\LPA9(29)M	43	84	3.3	4.7	18.3	20.4	22.0
BLK-AY	BL1801-3-1	B1403-19\LPA9(29)M	43	84	2.7	4.3	18.0	20.0	21.7
BLK-AY	BL1813-4-1	LPA9(29)M\BEL1303-9	43	84	2.0	4.3	17.7	18.3	21.4
BLK-AY	BL1727-2	B1402_46_101\Lpa-02(06)	43	84	1.3	3.3	17.3	17.9	21.1
BLK-AY	BL1709-6	Lpa-10(09)\B1402-4-99	45	84	1.0	4.0	17.5	18.0	20.5
BLK-AY	BL1815-1-1	LPA9(29)M\BEL1291D	43	84	3.0	6.7	19.8	18.5	20.5
BLK-Prelim	B1906-5-1	LPA17-08-1\BL1402-46-101	48	90	2.0	2.7	19.3	18.4	20.3
BLK-AY	BL1703-2	Zenith\BEL1291d	43	84	2.7	5.0	18.5	18.1	20.1
BLK-AY	BL1802-7-1	B1403-19\LPA17-08	48	84	1.7	4.7	19.3	18.5	19.2
BLK-AY	B-LPA17-32-3	LPA145 \Zenith	47	84	2.3	5.0	18.7	15.0	18.3
BLK-Prelim	B1904-3-2	B18504\BL1402-46-101	48	90	1.7	3.0	16.7	18.1	18.1

BLK-AY	BL1810-2-1	LPA17-08\B1403-19	46	84	2.3	5.0	21.5	18.0	17.8
BLK-AY	BL1812-8-1	LPA17-08\B1402-15	43	84	2.3	4.7	14.5	18.2	17.2
BLK-AY	B-LPA17-34-2	LPA145 \Zenith	45	84	2.7	5.0	18.0	16.5	16.7
BLK-Prelim	B1905-1-2	LPA17-08-1\BL1402-15	45	90	3.7	4.3	19.0	17.0	16.5
BLK-Prelim	B1904-3-1	B18504\BL1402-46-101	48	90	2.3	3.7	20.3	15.8	16.5
BLK-AY	BL1814-2-1	LPA17-08\BEL1303-9	43	84	1.0	4.3	15.2	18.7	16.2
BLK-Prelim	B1906-5-2	LPA17-08-1\BL1402-46-101	45	90	2.0	3.3	17.3	17.7	15.8
BLK-AY	BL1801-6-1	B1403-19\LPA9(29)M	43	.	2.0	5.7	17.7	18.6	15.7
BLK-Prelim	B1905-2-1	LPA17-08-1\BL1402-15	46	84	2.0	4.0	16.7	20.7	15.1
BLK-AY	BL1814-6-1	LPA17-08\BEL1303-9	43	84	2.7	5.3	17.5	16.3	14.8
BLK-AY	BL1812-6-1	LPA17-08\B1402-15	43	84	1.0	4.0	16.3	17.8	13.7
BLK-Prelim	B1905-1-1	LPA17-08-1\BL1402-15	43	88	3.3	4.3	16.0	17.8	12.5
BLK-AY	BL1717-1	Lpa-10(17)\BEL1303-10	43	84	2.3	4.3	17.3	19.1	9.9
BLK-Check	Adams	MSU variety	43	86	2.0	2.0	20.3	17.8	28.6
BLK-Check	Zenith	MSU variety	43	84	1.3	3.0	16.7	18.5	24.1
BLK-Check	Zorro	MSU variety	44	84	2.0	2.3	18.0	18.6	21.7
BLK-Check	Eclipse	NDSU variety	43	84	1.7	3.3	18.7	20.0	20.3

[1]Lodging: Based on a scale of 1 to 5 where 1 is completely upright and 5 is completely prostrate.

[2]Plant Desirability: Rating on a 1 to 9 scale where 1 is the most desirable agronomically and 9 is the least desirable.

Table 2. USDA-ARS 2021 Cranberry Bean Advanced and Preliminary Yield Trials at the Montcalm Research Farm in Entrican, Michigan

Expt	Genotype	Pedigree	Flowering	Maturity	Lodging[1]	Plant Desirability[2]	Seed Wt	Seed Yield
			dap	dap	(1-5)	(1-9)	g/100 seeds	CWT
Cran AY	CR1804-2-2	ADP0562\ADP0517	43.0	94.7	3.3	5.0	46.9	29.4
Cran Prelim	CR1937-1-1	SR1227-038\PIC8	42.0	97.0	2.0	3.0	55.8	29.3
Cran AY	CR1803-3-1	ADP0562\Etna	42.0	97.0	1.0	2.3	46.0	26.8
Cran Prelim	CR1917-3-2	PIC3\CR1402-1	41.0	93.5	3.5	3.5	46.2	26.5
Cran AY	CR1801-2-1	ADP0562\Bellagio	41.0	92.3	2.7	4.3	48.8	25.9
Cran Prelim	CR1921-2-1	PIC3\PIC8	42.0	97.0	2.0	2.5	54.6	25.8
Cran AY	CR1804-3-1	ADP0562\ADP0517	42.0	95.7	1.7	3.3	44.6	25.8
Cran Prelim	CR1809-1-1	CR1504_12\CM433	42.5	93.5	1.5	3.5	43.8	25.0
Cran AY	CR1801-2-2	ADP0562\Bellagio	41.0	90.0	2.0	3.0	55.1	24.9
Cran Prelim	CR1937-1-2	SR1227-038\PIC8	42.0	97.0	2.0	4.0	56.1	24.8
Cran AY	CR1802-1-2	ADP0562\MICran	42.0	98.0	3.7	4.3	53.2	24.4
Cran Prelim	CR1941-1-1	SR1227-082\CR1402-1	41.5	.	4.0	4.5	54.4	24.0
Cran Prelim	CR1921-3-2	PIC3 \PIC8	46.0	90.0	1.5	3.0	45.4	23.9
Cran AY	CR1802-1-3	ADP0562\MICran	42.0	90.0	1.5	4.3	50.5	23.7
Cran Prelim	CR1934-2-1	SR1227-038\CR1502-1	41.0	90.0	2.0	4.0	45.1	23.6
Cran AY	CR1803-2-1	ADP0562\Etna	41.7	90.0	1.0	2.3	51.8	23.3
Cran AY	CR1801-3-1	ADP0562\Bellagio	41.0	92.3	1.7	3.3	59.7	23.0

Cran AY	CR1805-1-1	ADP0562\ADP0576	43.0	94.7	1.0	2.0	46.0	22.6
Cran Prelim	CR1809-2-3	CR1504_12\CM433	42.0	93.5	1.5	2.5	42.2	22.5
Cran AY	CR1807-1-1	ADP0562\Snowdon	43.0	92.3	3.0	2.3	47.4	21.7
Cran Prelim	CR1913-1-1	CR1512-2\PIC8	45.0	90.0	1.0	3.0	55.6	20.7
Cran AY	CR1801-6-1	ADP0562\Bellagio	41.0	92.3	1.7	3.3	60.6	20.6
Cran Prelim	CR1917-3-1	PIC3\CR1402-1	41.0	93.5	1.5	3.0	46.9	20.5
Cran Prelim	CR1937-1-3	SR1227-038\PIC8	42.0	97.0	1.0	3.0	54.7	20.0
Cran AY	CR1807-1-2	ADP0562\Snowdon	41.3	90.0	2.7	1.7	49.7	18.0
Cran AY	CR1703-2	ADP0562\14L1203C	37.7	84.0	1.3	3.0	45.4	17.9
Cran Prelim	CR1917-1-1	PIC3\CR1402-1	41.0	.	.	5.0	50.7	17.8
Cran Prelim	CR1921-2-2	PIC3\PIC8	44.5	100.0	4.0	4.0	54.5	17.8
Cran Prelim	CR1809-2-2	CR1504_12\CM433	41.0	90.0	1.0	3.0	50.7	17.8
Cran AY	CR1805-2-3	ADP0562\ADP0576	43.0	96.7	1.0	3.7	48.3	17.4
Cran AY	14L1203B		39.0	88.0	2.0	4.0	53.3	16.9
Cran Prelim	CR1809-2-1	CR1504_12\CM433	41.0	89.0	1.0	3.0	43.0	16.9
Cran Prelim	CR1921-1-1	PIC3\PIC8	42.0	90.0	1.0	4.0	50.9	16.9
Cran AY	CR1802-3-2	ADP0562\MICran	41.0	86.7	1.3	4.0	36.6	16.8
Cran Prelim	CR1916-1-1	CR1512-2\Wit-rood boontje	41.0	87.5	1.5	3.0	42.0	16.3
Cran AY	CR1806-1-1	ADP0562\ADP0168	42.0	95.7	1.0	3.3	44.3	15.7
Cran Prelim	CR1939-2-1	SR1227-038\W6-51279	47.0	.	3.0	4.0	37.1	15.5
Cran Prelim	CR1921-3-1	PIC3\PIC8	43.5	90.0	2.0	3.0	51.2	14.2
Cran Prelim	CR1902-3-1	14L1203B\CR1502-1	38.0	89.0	1.5	4.0	39.0	13.1

Cran Prelim	CR1906-1-1	14L1203B\W6-51239	38.0	97.0	2.0	3.0	53.1	12.0
Cran Prelim	CR1919-2-2	PIC3 \CR1503-4	41.0	90.0	1.0	3.0	49.1	11.6
Cran AY	CR1703-1	ADP0562\14L1203C	37.7	85.0	1.0	4.7	49.2	11.4
Cran Prelim	CR1909-3-1	CR1512-2\CR1402-1	42.0	.	2.0	4.0	48.8	11.1
Cran Prelim	CR1934-1-2	SR1227-038\CR1502-1	46.0	.	2.0	4.0	35.8	11.0
Cran Prelim	CR1913-1-3	CR1512-2\PIC8	43.5	93.5	1.0	4.0	53.9	11.0
Cran Prelim	CR1939-1-1	SR1227-038\W6-51279	47.0	.	1.5	4.0	35.9	10.7
Cran Prelim	CR1934-1-1	SR1227-038\CR1502-1	44.5	97.0	2.0	4.0	31.6	10.5
Cran Prelim	CR1918-2-1	PIC3\CR1502-1	41.0	90.0	1.0	3.5	50.9	10.2
Cran Prelim	CR1943-1-1	SR1227-082\CR1503-4	51.0	.	5.0	5.0	39.3	9.9
Cran Prelim	CR1919-2-1	PIC3 \CR1503-4	41.0	85.0	2.0	4.0	43.7	9.1
Cran AY	CR1701-3	ADP0562\ADP0663 (USCR-CBB-20)	41.0	88.7	1.7	4.3	58.1	8.6
Cran Prelim	CR1913-1-2	CR1512-2\PIC8	42.0	90.0	2.0	3.5	57.2	8.4
Cran AY	CR1701-1	ADP0562\ADP0663 (USCR-CBB-20)	41.0	89.3	2.0	4.3	56.5	7.0
Cran Prelim	CR1907-3-1	14L1203B\W6-51279	41.0	88.0	1.0	4.0	39.3	1.7
Cran-Check	Etna	Seminis Seeds	41.3	90.0	1.0	4.0	54.6	4.6 (poor seed germ)
Cran-Check	MI Cran	Michigan Heirloom (indeterminate)	42.0	98.0	5.0	5.0	51.1	28.3
Cran-Check	Bellagio	MSU variety (indeterminate)	41.7	92.3	3.3	4.3	53.9	21.9

[1]Lodging: Based on a scale of 1 to 5 where 1 is completely upright and 5 is completely prostrate.

[2]Plant Desirability: Rating on a 1 to 9 scale where 1 is the most desirable agronomically and 9 is the least desirable.

Table 3. USDA-ARS 2021 Kidney Bean Advanced and Preliminary Yield Trials at the Montcalm Research Farm in Entrican, Michigan

Expt	Genotype	Pedigree	Flowering	Maturity	Lodging[1]	Plant Desirability[2]	Seed Wt.	Seed Yield
			dap	dap	(1-5)	(1-9)	g/100 seeds	CWT
Kidney AY	DRK1601-1	ADP0778\1531JB	40.0	88.3	1.0	3.0	52.7	25.4
Kidney Prelim	K1910-1-1	SR1227-168\ADP0604	47.0	93.5	1.5	1.5	40.9	25.2
Kidney AY	JC1803-1-1	UCD 0908\UCD 0701	43.0	97.0	2.0	2.3	46.9	24.6
Kidney AY	WK1601-1	Y11405\ADP512	43.0	88.7	1.3	2.0	43.1	24.4
Kidney AY	JC1803-6-1	UCD 0908\UCD 0701	42.0	92.3	1.5	1.3	49.7	24.3
Kidney AY	DRK1601-3	ADP0778\1531JB	42.0	90.0	1.3	3.0	51.2	24.0
Kidney AY	JC1803-3-1	UCD 0908\UCD 0701	44.0	94.7	1.3	2.3	56.2	23.8
Kidney AY	JC1803-4-1	UCD 0908\UCD 0701	44.0	92.3	1.7	2.0	51.2	23.1
Kidney Prelim	DRK1805-1-1	K16640\ADP0469	47.0	93.5	2.0	2.5	51.7	23.1
Kidney Prelim	DRK1922-1	PIC19\Red Cedar	41.0	90.0	2.0	2.0	51.3	22.1
Kidney AY	WK1601-2	Y11405\ADP512	43.0	88.3	1.0	2.7	40.1	21.5
Kidney AY	LRK1701-2	K15901\TZ-37	37.7	90.0	2.3	4.3	50.2	21.3
Kidney Prelim	WK1802-4-1	ADP0587\Snowdon	44.5	93.5	3.0	2.5	44.5	21.0
Kidney AY	WK1602-1	Snowdon\ADP521	42.0	86.0	1.3	3.0	48.2	20.8
Kidney Prelim	WK1806-1-2	K16136\ADP0469	47.0	97.0	2.0	2.0	35.9	20.0
Kidney AY	WK1602-2	Snowdon\ADP521	43.0	86.0	1.7	4.0	40.3	19.3
Kidney AY	LRK1701-3	K15901\TZ-37	37.7	88.3	1.3	4.3	50.2	19.2

Kidney Prelim	K1913-1	SR1227-168\PIC49	47.0	100.0	.	4.0	53.9	17.9
Kidney Prelim	WK1806-1-1	K16136\ADP0469	48.0	.	3.0	4.5	40.1	15.2
Kidney Prelim	K1910-1-2	SR1227-168\ADP0604	36.0	97.0	1.5	3.5	38.6	15.0
Kidney Prelim	DRK1922-2-2	PIC19\Red Cedar	46.0	90.0	2.0	4.0	41.8	12.5
Kidney Prelim	LRK1902-1	ADP0603\K15601	39.5	95.0	1.0	4.5	47.1	12.2
Kidney Prelim	DRK1922-2-1	PIC19\Red Cedar	46.0	90.0	2.0	3.5	36.6	11.4
Kidney Prelim	WK1805-2-2	ADP0781\Snowdon	36.0	86.5	1.0	4.0	44.8	10.0
Kidney Prelim	K1902-1	SR1227-168\K16136	36.0	87.5	1.0	4.5	43.9	8.4
Kidney Prelim	WK1804-7-1	ADP0106\Snowdon	36.0	86.5	1.0	4.5	54.0	6.4
Kidney Prelim	DRK1802-2-1	UCD 0701\Snowdon	37.0	85.0	1.0	4.0	48.1	5.3
Kidney-Check	Coho	MSU Variety	44.7	90.0	1.7	1.0	44.6	33.1
Kidney-Check	Snowdon	MSU Variety	36.0	88.3	2.0	3.7	53.0	19.2
Kidney-Check	Cluoseau	Seminis Seeds	39.0	88.3	1.3	4.0	58.3	17.1
Kidney-Check	Red Hawk	MSU Variety	41.0	86.7	1.7	3.7	49.0	15.4

[1]Lodging: Based on a scale of 1 to 5 where 1 is completely upright and 5 is completely prostrate.

[2]Plant Desirability: Rating on a 1 to 9 scale where 1 is the most desirable agronomically and 9 is the least desirable.

Table 4. USDA-ARS 2021 Yellow Bean Advanced and Preliminary Yield Trials at the Montcalm Research Farm in Entrican, Michigan

Expt	Genotype	Pedigree	Flowering	Maturity	Lodging[1]	Plant Desirability[2]	Seed Wt.	Seed Yield
			dap	dap	(1-5)	(1-9)	g/100 seeds	CWT
Yellow AY	RRY1803-1-1	ADP0512\Patron	41.7	87.7	1.0	3.0	38.8	22.0
Yellow AY	RRY1801-1-1	ADP0476 \Patron	42.3	90.0	2.0	4.0	25.0	21.7
Yellow AY	Y1608-07	Y11405\ADP521	41.0	89.3	2.7	3.3	36.5	20.1
Yellow AY	Y1802-9-1	ADP0781\Patron	39.7	89.0	1.5	2.7	35.3	19.0
Yellow AY	Y1608-09	Y11405\ADP521	41.0	87.7	2.0	3.0	39.4	18.0
Yellow AY	Y1703-21	ADP0781\Y11405	38.7	87.0	1.0	1.7	44.0	17.6
Yellow AY	Y1803-5-3	ADP0781\mayacoba	42.0	88.7	2.0	3.0	36.9	17.6
Yellow Prelim	Y1960-1-1	YBC190\YBC196	41.0	85.0	1.0	2.0	39.7	16.4
Yellow Prelim	Y1963-2-1	YBC190\YBC211	36.0	85.0	1.0	3.0	41.5	15.3
Yellow AY	Y1802-2-1	ADP0781\Patron	42.7	89.3	2.0	4.0	35.8	15.0
Yellow AY	Y1801-1-1	ADP0781\Snowdon	36.0	90.0	1.0	3.7	35.3	14.9
Yellow AY	Y1610-01	DYB-28-1\ADP-521	41.7	85.0	3.0	4.7	41.0	14.7
Yellow Prelim	Y1904-1	YBC003\YBC196	36.0	82.0	1.0	4.0	37.7	14.4
Yellow AY	Y1803-8-1	ADP0781\mayacoba	36.0	90.0	1.3	2.3	35.5	13.6
Yellow AY	Y1701-03	ADP0781\Marafax	37.7	86.7	1.0	3.3	33.6	13.5
Yellow Prelim	Y1960-1-2	YBC190\YBC196	41.0	97.0	2.0	2.0	41.4	13.4
Yellow AY	Y1608-14	Y11405\ADP521	36.7	86.0	1.7	3.7	37.7	13.4

Yellow AY	Y1804-1-1	ADP0781\ADP0791	41.3	90.0	1.7	4.0	29.1	13.1
Yellow AY	Y1702-22	ADP0781\Akaryose	39.3	90.0	1.0	3.0	34.0	13.1
Yellow Prelim	Y1963-2-3	YBC190\YBC211	36.0	90.0	1.0	3.0	43.2	13.1
Yellow AY	Y1609-02	Y11405\ADP512	36.7	82.0	1.0	4.0	39.0	12.9
Yellow AY	RRY1803-1-2	ADP0512\Patron	41.7	87.0	1.7	3.3	41.8	12.5
Yellow Prelim	Y1963-1-1	YBC190\YBC211	38.0	85.0	1.0	3.0	36.9	11.8
Yellow Prelim	Y1983-2-1	YBC228\YBC195	41.0	.	.	4.0	39.9	10.9
Yellow Prelim	Y1951-1-1	YBC178\YBC195	41.0	90.0	1.0	3.0	36.4	10.8
Yellow Prelim	Y1923-2-2	YBC063\YBC211	41.0	82.0	1.0	3.0	46.6	9.7
Yellow Prelim	Y1980-3-1	YBC200\YBC212	41.0	90.0	1.0	3.0	37.0	9.3
Yellow AY	Y1609-14	Y11405\ADP512	36.0	82.0	1.0	4.7	40.7	8.9
Yellow Prelim	Y1983-2-3	YBC228\YBC195	41.0	90.0	1.0	4.0	29.5	8.6
Yellow AY	Y1802-11-2	ADP0781\Patron	36.0	87.0	1.0	4.3	33.8	8.3
Yellow Prelim	Y1983-2-2	YBC228\YBC195	41.0	.	1.0	5.0	34.1	8.2
Yellow Prelim	Y1920-1-1	YBC063\YBC196	38.0	85.0	1.0	4.0	37.2	8.0
Yellow AY	Y1802-11-1	ADP0781\Patron	36.0	88.0	1.0	3.7	33.4	8.0
Yellow Prelim	Y1934-5-2	YBC114\YBC122	41.0	90.0	1.0	3.0	39.0	7.8
Yellow Prelim	Y1923-2-1	YBC063\YBC211	41.0	85.0	2.0	3.0	48.3	7.4
Yellow Prelim	Y1904-2	YBC003\YBC196	36.0	85.0	1.0	4.0	37.4	6.6
Yellow Prelim	Y1980-2-1	YBC200\YBC212	37.0	82.0	1.0	4.5	34.8	5.9
Yellow Prelim	Y1934-2-2	YBC114\YBC122	41.0	85.0	1.0	4.0	38.8	5.2
Yellow Prelim	Y1983-1-1	YBC228\YBC195	47.0	.	4.0	5.0	37.4	5.2

Yellow Prelim	Y1934-5-1	YBC114\YBC122	41.0	85.0	1.0	3.0	39.6	5.1
Yellow Prelim	Y1923-1-2	YBC063\YBC211	41.0	85.0	2.0	4.0	41.1	4.4
Yellow Prelim	Y1934-2-3	YBC114\YBC122	36.0	90.0	1.0	3.0	43.5	4.4
Yellow Prelim	Y1963-2-2	YBC190\YBC211	41.0	.	.	5.0	37.8	3.0
Yellow Prelim	Y1934-2-1	YBC114\YBC122	41.0	90.0	1.0	4.0	37.6	2.1
Yellow Prelim	Y1923-1-1	YBC063\YBC211	41.0	85.0	1.0	4.0	.	.
Yellow-Check	Yellowstone	MSU variety	41.0	85.0	1.3	3.0	35.8	18.9
Yellow-Check	Patron	Oregon State variety	42.7	89.3	1.7	3.7	37.9	18.8
Yellow-Check	Y11405	Mexico	41.0	87.7	1.0	2.7	38.3	13.1
Yellow-Check	L11YL002	Alberta, Canada	36.0	82.0	1.0	4.3	39.7	11.0

[1]Lodging: Based on a scale of 1 to 5 where 1 is completely upright and 5 is completely prostrate.

[2]Plant Desirability: Rating on a 1 to 9 scale where 1 is the most desirable agronomically and 9 is the least desirable.

Dry Bean Response to In-Furrow Applications of Azoxystrobin Alone and In Combination With Fertilizer

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Location: SVREC	**Treated Plot Size:** 6.6' x 20'
Planting Date: June 6, 2021	**GPA:** 9.6
Replicated: 4 times	**PSI:** 10
Design: RCBD	**Application Timing:** 'A' at planting
Variety: Zenith Black Bean	**Nozzle:** T-Band
Population: 105,000 seeds/A	**Row Width:** 20-inch

Table 1. Treatments, application timing, stand counts, and dry bean yield.

#	Treatment	Application Timing	Stand Count/A		Yield [b]
			8 DAP [a]	89 DAP	
1	Untreated	-	81,662 ab	64,058 a	3626 a
2	SureCrop (3.3 gal/A)	A	78,396 ab	63,390 a	3700 a
3	Azteroid (5 fl. oz./A)	A	92,058 a	62,097 a	3403 ab
4	SureCrop (3.3 gal/A) + Azteroid (5 fl. oz./A)	A	81,009 ab	62,097 a	3239 b
5	Quadris (9.5 fl. oz./A)	A	72,516 b	60,136 a	3078 b

[a] Means within the same column with different letters are not significantly different from each other ($\alpha \leq 0.05$).
[b] Yield is in pounds per acres obtained by direct harvest, adjusted to 18% moisture.

Summary: A trial was established in 2021 to test dry beans tolerance to in-furrow applications of azoxystrobin (Azteroid or Quadris) alone and in combination with SureCrop (4-12-3 + Micros) fertilizer products. Trial quality was very good as a dry planting season did not interfere with dry bean plating or emergence at SVREC. All treatments were applied in a T-Band application method at 9.6 gallons per acre at planting. Eight days after planting dry bean vigor was not visually effected by any treatment and plots had reached maximum emergence. However, the treatment of Azteroid alone did have higher stand counts per acre than Quadris applied alone. This result should be interpreted with caution as the rate of azoxystrobin applied in lb. per acre was not equivalent between Azteroid and Quadris formulations and cannot be used as a reference for differing crop safety between formulations. None of the included treatments differed in stand count from the untreated at either eight days after planting, or immediately ahead of harvest at eighty nine days after planting. Significant levels of root disease were not present in the 2021 location and therefor was not evaluated. Yield was not significantly increased by any treatment in comparison to the untreated control, in contrast treatments of SureCrop + Azteroid as well as Quadris reduced dry bean yield by 387 and 548 lb. per acre, respectively.

Dry Bean Response to Alternative Seed Treatment and In-Furrow Fungicide Programs

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Location: SVREC	**Treated Plot Size:** 6.6' x 20'
Planting Date: June 6, 2021	**Variety:** Zorro black bean
Replicated: 4 times	**Population:** 105,000 seeds/A
Design: RCBD	**Row Width:** 20-inch
Application Timing: 'A' Seed Treatment	**GPA:** 10
'B' At Planting	**PSI:** 10

Table 1. Treatments, application timing, stand counts, and dry bean yield.

#	Treatment	Application Timing	Stand Count /A		Yield [a]
			8 DAP	89 DAP	
1	Untreated	-	97,395	74,093	3302
2	Propulse (6 fl. oz./A)	B	86,936	72,556	3231
3	Evergol Energy	A	101,317	73,863	3096
4	Evergol Energy + Propulse (6 fl. oz./A)	AB	94,780	74,301	3363

[a] Yield is in pounds per acre obtained by direct harvest, adjusted to 18% moisture.

Summary: A trial was established in 2021 to test dry beans response to seed treatments and in-furrow fungicide applications. Zorro black beans were planted with no seed treatment in treatments 1 (untreated) and 2 (Propulse). Evaluations included stand counts at 100% emergence (8 days after planting (DAP)), stand counts prior to harvest (89 DAP), and dry bean yield. Planting conditions were favorable for quick dry bean emergence into warm dry soils and did not indicate a significant benefit in plant population or yield to any treatment in the trial. Dry bean root diseases were not present in a great enough severity for the rating of product effects. Additional research should focus on inoculated trials or locations with a history of high severity of dry bean root diseases. Environmental impacts such as heavy rainfall and soil crusting may at times also impact results.

2021 Michigan Dry Bean Performance Trials: Large Seeded Market Classes

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Introduction: Sixty three (63) lines from large seeded market classes were tested at two Michigan locations in 2021. These sixty three lines came from five separate market classes: Light Red Kidney, Dark Red Kidney, White Kidney, Mayocoba/Yellow, and Cranberry Beans. In each table documenting the results, you will find agronomic information including flowering date, plant maturity, height, and disease tolerance. Flowering and plant maturity are rated visually in days after planting (DAP) across all locations. Lodging is evaluated on a scale of 1 to 5, with a 1 indicating that the entry was completely erect in the field at harvest and a 5 indicating that the entry was flat on the ground with stems and pods touching the soil surface. White mold was not present in either location where large seeded bean testing was conducted (Montcalm or SVREC), and was not, therefore, evaluated in 2021.

Yield results are presented in pounds per acre (lb. A^{-1}) adjusted to 18% moisture for both locations. When possible, following individual location results data was combined for multi-year averages. This was done for two- and three-year averages across locations and years. For example, a three-year average of Cranberry bean yields includes data from 2019, 2020, and 2021 at one location per year (3 site years).

At the bottom of most columns, you will find the trial average (mean), least significant difference (LSD), and coefficient of variation (CV) for the data within that column. To assist in the evaluation of these results the entry with the highest numerical yield in each column (trial and year) is followed by two asterisks (**). However, entries that are not significantly different from the highest yielding entry are followed by one asterisk (*). This means that if an entry is followed by either one or two asterisks, there is **no** evidence that the entries differed for that given trait.

Table 1. Trial location, grower co-operator, planting date, nitrogen application rate, nitrogen application method, total accumulated growing degree days (GDD), and total precipitation

County	Co-operator	Planting Date	Nitrogen Rate (lb/A)	Nitrogen application	Total GDD*	Total Precipitation (inches)
Tuscola (Kidney beans)	SVREC	6-June	42	Broadcast	2308	15.9"
Montcalm	Waldron Farms	3-June	42	2x2	2274	17.6" + Irrigation

*Weather data retrieved from the nearest Michigan Automated Weather Network (MAWN) and the Enviro-weather Program station nearest to the trial. All weather data is from the day of planting to October 1. Growing degree days were calculated using the following equation: ((MAX + MIN)/2)-50

Methods: Dry beans were seeded in four row plots (20" rows) that measure 6.6' wide by 20' long. Each entry is replicated **four** times within the trial. All trials were designed as a randomized complete block (RCB). Trials received industry standard seed treatments, fertilization, and weed control applications at labeled rates. White mold fungicides were not applied to any location.

The absence of fungicide allows the evaluation of a variety's natural tolerance or avoidance to white mold when the disease is present. Yield data is obtained by pulling and windrowing utilizing a two row 'Pickett' rod puller and then mechanically thrashed to prevent harvest loss. Following harvest, samples are cleaned, weighed, and moisture tested. Questions regarding the 2021 performance trials or suggestions for 2022 should be directed to Scott Bales at 989-262-8550, ext. 2 or balessco@msu.edu.

Table 2. Soil test information from the six county locations, including organic matter (%OM), pH, and cation exchange capacity (CEC). All macro- and micronutrients were sufficient for dry bean production.

Location	OM (%)	Soil Type	pH	CEC
Tuscola (SVREC)	2.5	Clay Loam	7.7	16.8
Montcalm	2.3	Sandy Loam	6.3	7.6

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Table 3. Cranberry bean agronomic and yield results

VARIETY	**Maturity** *dap*	**Flowering** *dap*	**Plant Height** *inch*	**Lodging** *(1-5)*	**Montcalm** *Lb. A^{-1}*	**Tuscola** *Lb. A^{-1}*	**Irrigated 2-year avg.** *Lb. A^{-1}*	**Irrigated 3-year avg.** *Lb. A^{-1}*	**Dry Land 2-year avg.** *Lb. A^{-1}*	**Dry Land 3-year avg.** *Lb. A^{-1}*
AAC Scotty	97	35	11.0	3.0	2809	2173	-----	-----	-----	-----
Amaranto	83	36	11.0	2.7	2988	2006	2765	3011*	1961	1664
Bellagio	83	36	13.0	3.0	2785	2498*	2323	2550	2296	1918
Chianti	84	39	12.0	2.0	3034	2305*	2709	2942	-----	-----
Etna	81	35	12.0	2.2	3461**	2107	3141*	3267**	2197*	1721
Jester	85	37	13.0	2.2	3326*	2308*	2820	2867	2507*	2130*
Vero	85	36	12.0	2.7	3239*	2134	2934*	2975	1947	-----
16756	89	38	13.0	2.2	3072	1973	2768	-----	1911	-----
16758	83	35	12.0	2.2	3205*	1958	2900	-----	1948	-----
16760	82	36	10.0	2.7	3333*	2307*	3168*	3152*	2138	1855
16764	81	38	11.0	4.0	2924	2200	2875	2842	2235*	1964*
16775	84	34	12.0	1.5	2795	1822	2520	2704	1994	1663
16776	84	47	15.0	1.5	2507	1983	-----	-----	-----	-----
16816	83	34	13.0	2.5	3096	1807	2848	-----	2003	-----
151093	83	37	13.0	2.5	3405*	2514**	3177**	2947	2519**	2166**
MEAN:	84	37	12.3	2.4	3066	2144	2842	2926	2138	1890
LSD$_{(0.05)}$:	-----	-----	-----	-----	361	286	265	260	202	237
CV:	-----	-----	-----	-----	9.8%	11.1%	11.2%	13.1%	16.3%	16.8%

**Highest yielding variety within column

*Yield not statistically different from the highest yielding variety within column

Table 4. Light Red Kidney bean agronomic and yield results

VARIETY	**Maturity** *dap*	**Flowering** *dap*	**Plant Height** *inch*	**Lodging** *(1-5)*	**Montcalm** *Lb. A^{-1}*	**Tuscola** *Lb. A^{-1}*	**Irrigated 2-year avg.** *Lb. A^{-1}*	**Irrigated 3-year avg.** *Lb. A^{-1}*	**Dry Land 2-year avg.** *Lb. A^{-1}*	**Dry Land 3-year avg.** *Lb. A^{-1}*
Big Red	81	34	12.0	2.5	3306	2429	2888*	2701*	2247*	1938
California Early	80	33	11.0	2.7	2922	2021	2858*	2691*	1949	1462
Clouseau	85	34	10.0	3.2	3211	2370	2848*	2687*	2381*	1713
Coho	84	40	15.0	2.2	2374	2765*	2522	2525*	2512**	2203
Pink Panther	83	34	11.0	2.5	3282	2089	2981*	-----	2106	-----
Red Dawn	79	35	12.0	2.7	2915	2423	3030**	2781**	2295*	1985
Ronnie's Red	85	39	15.0	1.7	2185	2715*	2131	2395	2498*	2188
Rosie	86	39	14.0	2.2	2058	2336	1845	-----	2252*	-----
11413	86	34	11.0	3.2	3331	2309	-----	-----	-----	-----
15916	84	35	9.0	3.5	3378*	2425	-----	-----	-----	-----
15923	84	34	12.0	2.2	3622*	2196	-----	-----	-----	-----
16998	84	35	11.0	2.0	3542*	2258	-----			-----
161082	84	36	14.0	2.0	3320	2144	-----			-----
K17703	85	36	14.0	2.0	-----	-----	2568	2443	2512*	2812**
K19610	83	40	12.0	2.2	-----	-----	-----	-----	-----	-----
K20734	85	38	15.0	1.7	2430	2928**	-----	-----	-----	-----
K20743	86	36	15.0	1.7	3643**	2832*	-----	-----	-----	-----
MEAN:	84	36	12.5	2.4	2966	2454	2629	2603	2306	2043
LSD$_{(0.05)}$:	-----	-----	-----	-----	458	317	368	322	345	342
CV:	-----	-----	-----	-----	13.0%	10.9%	16.7%	23.5%	15.4%	22.0%

**Highest yielding variety within column

*Yield not statistically different from the highest yielding variety within column

Table 5. Dark Red Kidney bean agronomic and yield results

VARIETY	**Maturity** *dap*	**Flowering** *dap*	**Plant Height** *inch*	**Lodging** *(1-5)*	**Montcalm** *Lb. A^{-1}*	**Tuscola** *Lb. A^{-1}*	**Irrigated 2-year avg.** *Lb. A^{-1}*	**Irrigated 3-year avg.** *Lb. A^{-1}*	**Dry Land 2-year avg.** *Lb. A^{-1}*	**Dry Land 3-year avg.** *Lb. A^{-1}*
Dynasty	85	38	14.0	2.2	3310*	2639	2955*	3008**	2519**	2223*
Epic	81	37	12.0	2.2	3021	2194	2713*	2750*	2162	2019
Gallantry	84	36	13.0	2.5	3316*	2355	-----	-----	-----	-----
Montcalm	86	30	13.0	2.5	3218*	2650**	2675*	2793*	2406*	2064
Rampart	83	37	12.0	2.2	3182*	2462*	2755*	2688	2361*	2070
Red Cedar	85	36	12.0	2.7	2788	2470*	2721*	2592	2195	2066
Red Hawk	85	35	11.0	3.0	2875	1729	2738*	2916*	1771	1754
Red Rover	85	37	13.0	2.7	2541	2255	2565	2759*	2173	1926
15977	85	37	14.0	2.7	3465**	2506*	2731*	-----	2359*	-----
15978	86	40	12.0	2.0	1468	2061	1896	1906	2169	2278**
151011	81	36	11.0	3.8	3287*	2261	3045**	2967*	2152	2008
161156	84	37	11.0	2.2	3283*	2335	3006*	-----	2360*	-----
161164	84	36	11.0	2.5	3089*	2121	2774*	-----	2221	-----
181017	85	40	14.0	2.2	3408*	2561*	2850*	-----	2259*	-----
181020	84	33	10.0	3.0	2620	1820	-----	-----	-----	-----
181021	84	34	10.0	2.5	2794	2102	-----	-----	-----	-----
K16136	84	37	14.0	2.2	2643	2467*	2674*	2746*	2312*	2075
K20234	83	37	11.0	2.2	2824	2104	-----	-----	-----	-----
MEAN:	84	36	12.1	2.5	2952	2283	2721	2712	2244	2048
LSD$_{(0.05)}$:	-----	-----	-----	-----	430	287	391	291	288	225
CV:	-----	-----	-----	-----	12.2%	10.6%	17.3%	15.8%	13.3%	14.8%

**Highest yielding variety within column

*Yield not statistically different from the highest yielding variety within column

Table 6. White Kidney bean agronomic and yield results

VARIETY	**Maturity** *dap*	**Flowering** *dap*	**Plant Height** *inch*	**Lodging** *(1-5)*	**Montcalm** *Lb. A^{-1}*	**Tuscola** *Lb. A^{-1}*	**Irrigated 2-year avg.** *Lb. A^{-1}*	**Irrigated 3-year avg.** *Lb. A^{-1}*	**Dry Land 2-year avg.** *Lb. A^{-1}*	**Dry Land 3-year avg.** *Lb. A^{-1}*
Beluga	86	38	14.0	2.5	2161	2448	2116	2388	2296	2331**
ND WhiteTail	85	38	14.0	3.0	2663	2591	2588	-----	2346	-----
Snowdon	82	33	10.0	2.5	2988*	2177	-----	-----	-----	-----
Yeti	87	37	14.0	2.2	2678*	2573	2258	2774	2362	2004
K16924	86	35	11.0	2.7	3098**	2566	3113**	3476**	2403	2177*
K19830	85	40	15.0	2.0	2861*	3038**	2728	-----	2697**	-----
K19831	86	40	16.0	2.0	2448	2872	-----	-----	-----	-----
MEAN:	85	37	14	2.7	2699	2609	2561	2879	2421	2171
LSD$_{(0.05)}$:	-----	-----	-----	-----	425	118	280	261	176	249
CV:	-----	-----	-----	-----	12.8%	3.6%	12.8%	18.4	6.7%	19.0%

**Highest yielding variety within column

*Yield not statistically different from the highest yielding variety within column

Table 7. Mayocoba/Yellow bean agronomic and yield results

VARIETY	**Maturity** *dap*	**Flowering** *dap*	**Plant Height** *inch*	**Lodging** *(1-5)*	**Montcalm** *Lb. A^{-1}*	**Tuscola** *Lb. A^{-1}*	**Irrigated 2-year avg.** *Lb. A^{-1}*	**Irrigated 3-year avg.** *Lb. A^{-1}*	**Dry Land 2-year avg.** *Lb. A^{-1}*	**Dry Land 3-year avg.** *Lb. A^{-1}*
Claim Jumper	85	39	12.0	3.7	2750*	2560	2414*	2576	2305	2029
Motherlode	89	36	14.0	2.7	1756	2161	-----	-----	-----	-----
Patron	80	37	10.0	4.0	2843*	3223**	-----	-----	-----	-----
SVS-0863	80	38	10.0	4.0	3047**	3146*	2485*	2791*	2719**	2618**
Yellowstone	86	37	10.0	3.5	2575*	2501	2541**	2845**	2182	2008
Y1608-14	82	36	11.0	4.2	2408*	1674	2354*	-----	1905	-----
Y1702-22	83	34	11.0	2.7	2922*	2092	2397*	-----	2031	-----
MEAN:	84	37	11.1	3.5	2614	2479	2438	2737	2252	2218
LSD$_{(0.05)}$:	-----	-----	-----	-----	462	232	265	247	274	172
CV:	-----	-----	-----	-----	14.2%	7.6%	12.7%	12.8%	13.0%	10.4

**Highest yielding variety within column

*Yield not statistically different from the highest yielding variety within column

Black Bean Yield Response To Planting Rate

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Locations: SVREC	**Plot Size:** 6.6' x 20'
Planting Date: June 6, 2021	**Replicated:** 4 times (RCBD)
Variety: Zenith Black Bean	**Row Spacing:** 20-inch

Figure 1. Treatments, planted populations, final plant populations at harvest, percent of planted stand, and dry bean yield

Treatment:	Planted Population	Harvested Population	Percent Stand (Planted ÷ Harvested) * 100	Yield**
1	50,000	38,565	77.1%	2849 d*
2	60,000	45,101	75.1%	3079 cd
3	70,000	49,677	70.9%	3106 c
4	80,000	49,029	61.2%	3152 c
5	90,000	54,906	61.0%	3313 c
6	100,000	50,331	50.3%	3460 bc
7	110,000	64,057	58.2%	3775 a
8	120,000	69,940	58.2%	3626 ab
9	130,000	70,594	54.3%	3786 a
10	140,000	72,555	51.8%	3745 a
11	150,000	74,516	49.6%	3546 ab

*Columns within the same location with different letters are significantly different from each other ($\alpha \leq 0.05$).
**Yield is in pounds per acres obtained by direct harvest and adjusted to 18% moisture.

Summary: In efforts of better examining the effects of altering planting populations on Michigan black beans, a trial was established at SVREC in 2021. Zenith black beans were planted on June 6, 2021 using a 4 row Almaco cone type planter. Eleven total treatments were included ranging from 50,000 to 150,000 seeds per acre. Stand counts were conducted at eighty nine (89) days after planting to provide a final plant population at harvest corresponding to the original planting populations. An important note is through the use of a cone planter the error rate in the seeding population is very low, individual seeds are counted out into planting envelopes ahead of planting and thus determine the final seeded population/density and is considered very accurate. However, precision metered planters may provide more uniform individual seed spacing. This raises an interesting point when we analyze the differences between planted and harvested populations. Results demonstrate a numerical increase in seedling mortality throughout the growing season for higher planting populations when compared to lower (33% loss for 50,000; 51% loss for 150,000). This may be mitigated by more precise seed spacing in some commercial planters (Lower % of doubles and/or skips per row foot).Yield results indicated that optimal seeding rates for 20" rows are 110,000-150,000 seeds per acre. However, previous research has also documented the increased risk of foliar disease under increased planting populations (>130,000 seeds per acres). Therefore current planting recommendations of 110,000-130,000 seeds per acre are considered optimal for dry bean yield potential in 20" rows.

Dry Bean Response to In-Furrow Applications of Propulse In Two Michigan Locations

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Location: SVREC (June 6, 2021)	**Treated Plot Size:** 6.6' x 20'
Kawkawlins (May 31, 2021)	**GPA:** 10
Replicated: 4 times	**PSI:** 10
Design: RCBD	**Application Timing:** 'A' at planting
Variety: Zenith Black Bean	**Nozzle:** TP8002Vs
Population: 105,000 seeds/A	**Row Width:** 20-inch

Table 1. Treatments, application timing, stand counts, and dry bean yield.

#	Treatment	Application Timing	Stand Count/A		Yield *
			8 DAP	89 DAP	
1	Untreated	-	72,216	66,006	3505
2	Propulse 6 fl. oz./A	A	68,295	58,164	3225
3	Propulse 8 fl. oz./A	A	77,934	53,131	3487
4	Propulse 10 fl. oz./A	A	82,999	64,537	3350

*Yield is in pounds per acre obtained by direct harvest, adjusted to 18% moisture.

Summary: A trial was established in 2021 to test dry beans tolerance to in-furrow applications of multiple rates of Propulse fungicide. Applications were made from 6- 10 fl. oz. per acre directly into the seed furrow at planting. This trial was not inoculated with any specific root rot pathogens and natural disease pressure was not great enough for evaluation of root rot. Seed for all treatments was treated with a standard Cruiser Max Vibrance (3.22 fl. oz. per 100 Lb. of seed) seed treatment prior to planting. When data were combined over two locations neither evaluation of stand count nor yield were significantly impacted by fungicide application when compared to the untreated control ($P \leq 0.05$). While this trial demonstrated an acceptable level of crop safety at the rates tested, additional research is required to better understand the impact Propulse may have on dry bean root diseases.

The Effect of EndoPrime Biological on Dry Bean Production

Scott Bales, MSU Dry Bean Specialist
(989)- 262-8550; balessco@msu.edu

Location: SVREC	**Treated Plot Size:** 6.6' x 20'
Planting Date: June 6, 2021	**Variety:** Zenith black bean
Replicated: 4 times	**Population:** 105,000 seeds/A
Design: RCBD	**Row Width:** 20-inch
Application Timing: 'A' At Planting	**2X2:** 15 GPA @ 12 PSI
	In-Furrow: 10 GPA @ 10 PSI

Table 1. Treatments, application timing, application placement, stand counts, and dry bean yield.

#	Treatment	Application Timing	Application Placement	Stand Count/A	Yield *
				89 DAP	
1	Untreated	-	-	55,953	2849
2	EndoPrime (2 fl. oz./A)	A	In-Furrow	58,567	2777
3	EndoPrime (2 fl. oz./A)	A	2x2 Coulter	61,705	3135

* Yield is in pounds per acre obtained by direct harvest, adjusted to 18% moisture.

Summary: A trial was established in 2021 to test dry beans response to a biological product applied in two separate methods. An untreated control was also utilized for comparison of treatment effects. All treatments received 42 lb/A of actual nitrogen from a broadcast application of 28-0-0 liquid fertilizer prior to the incorporation of PPI herbicides. For both application methods water was used as the carrier for EndoPrime biological. Evaluations included stand counts (89 days after plating (DAP)) and dry bean yield (Adjusted to 18% moisture). For either application method EndoPrime did not significantly affect dry bean plant populations or yield. Trials were of high quality and did not have significant levels of root or foliar bean diseases in any of the included treatments.

MICHIGAN STATE UNIVERSITY EXTENSION

Michigan State University AgBioResearch

Spring-planted cover crop effects on dry edible beans

Christy Sprague and Scott Bales, Michigan State University

Location: Richville (SVREC)	**Tillage:** No-till
Soil Type: clay loam **O.M.:** 2.4% **pH:** 8.0	**Variety:** 'Black Bear' black beans
Replicated: 4 times	**Population:** 109,000 seeds/A
Cover crop planting date: March 22, 2021	**Planting date:** June 2, 2021
Cover termination: May 22, 2021	**POST application date:** July 6, 2021[d]

Table 1. Effect of spring-planted cover crops on weed suppression and dry bean growth and yield.

	Cover crop[a]		Weed[a]			
	Biomass	**Height**	**Counts**	**Biomass**	**Stand[b]**	**Yield**
Treatments[c]	— lbs/A —	— inches —	— #/m^2 —	— g/m^2 —	— #/ft —	— cwt/A —
No cover	0	0	22	3.5	4.7	29.8
Oats (1 bu/A)	364	10	14	1.0	3.1	25.6
Oats (2 bu/A)	520	10	5	0.1	1.2	23.5
Cereal rye (1 bu/A)	302	5	20	4.7	3.3	26.5
Cereal rye (2 bu/A)	416	6	5	0.2	3.3	26.3
Winter wheat (1 bu/A)	217	4	13	0.9	4.0	31.9
Winter wheat (2 bu/A)	213	4	14	0.5	3.8	25.3
$LSD_{0.05}$[e]	*193*	*0.5*	*14*	*N.S.*	*0.65*	*5.6*

[a] Cover crop biomass, heights, weed counts and biomass were measured just prior to cover crop termination.
[b] Dry bean stand counts were taken 1 week after planting.
[c] Cover crops were terminated with Roundup PowerMax at 32 fl oz/A + AMS.
[d] A POST application of Raptor (4 fl oz) + Basagran (16 fl oz) + Reflex (8 fl oz) + COC + AMS was applied to the entire trial on July 6, 2021.
[e] Means within a column greater than least significant difference (LSD) value are different from each other.

Summary: Cover crops have been used to suppress weeds, as well as provide several other benefits, in many different crops. Since dry beans are planted later in the season, fall-planted cover crops may have too much growth prior to dry bean planting that could potential interfere with dry bean growth and suppress yield. This trial was conducted to determine what effects spring planted cereal cover crops may have on early-season weed suppression and dry bean growth. Oats, cereal rye, and winter wheat were all planted at two different seeding rates in late March and were allowed to grow for approximately 2 months. The cereal cover crops were terminated approximately 2 weeks prior to dry bean planting. At the time of termination, cover crop biomass, height, weed counts and biomass were measured. Oats and cereal rye provided the greatest cover crop biomass and wheat provided the least amount of biomass. Within each cover crop there was no statistical difference cover biomass due to seeding rate. Oats were the tallest cover, followed by cereal rye, and then wheat. Weed numbers were only reduced in oats and cereal rye planted at 2 bu/A compared with the no cover control, however there were no differences in weed biomass. Oats, cereal rye, and the high rate of winter wheat also slowed down dry bean emergence. At the end of the season, dry bean yield was for all cover crops was similar to the no cover control, except for dry beans planted in terminated oats at the highest seeding rate.

Official Variety Trial

SVREC, Richville - 2021

Trial Quality: Good
Planted: April 14
Harvested: October 20
Plots: 2 Rows X 38 ft., 8 reps
Row Width: 22 in.
Seeding Rate: 1.9 in. thinned to 200 beets/100'

Soil Info: Clay Loam
% OM: 3.6 **pH:** 7.5 **CEC:** 16.7
P: Above Opt **K:** Above Opt
Mn: High **B:** Low
Prev Crop: Corn
Added N: 35 lbs. 2x2, 100 lbs. PPI

Disease Pressure:
Cerc: Low/Moderate
Rhizoc: Low/Moderate
Rainfall: 16.62 in.

Variety	$/A	RWSA	RWST		Yield		Sugar		CJP		Emerge	
			Lb/T	Rank	T/A	Rank	%	Rank	%	Rank	%	Rank
C-G049	**$2,744**	**14306**	259	13	**55.3**	**1**	17.2	17	**96.1**	**12**	**55.2**	**1**
C-G675	**$2,623**	**13674**	262	10	**52.1**	**3**	**17.5**	**8**	95.9	18	**50.4**	**8**
C-G932NT	**$2,589**	**13500**	264	8	51.1	7	**17.4**	**9**	**96.4**	**6**	**52.2**	**4**
BTS-1941	**$2,579**	**13447**	255	22	**52.7**	**2**	17.2	14	95.3	24	**49.9**	**10**
C-G919	**$2,552**	**13308**	256	17	**51.6**	**5**	17.0	21	**96.6**	**3**	**49.5**	**11**
C-G021	**$2,529**	**13183**	255	20	51.3	6	17.0	20	**96.1**	**13**	**46.4**	**13**
BTS-197N	**$2,525**	**13164**	260	12	50.6	8	17.4	11	95.7	21	**45.8**	**15**
HIL-2332NT	**$2,524**	**13159**	**277**	**1**	47.6	12	**18.1**	**1**	**96.7**	**2**	**46.3**	**14**
BTS-1065	$2,507	13073	253	24	**51.6**	**4**	16.9	25	96.0	16	**51.4**	**6**
HIL-9865	$2,419	12611	**274**	**2**	44.9	22	**18.0**	**2**	**96.2**	**9**	44.7	17
SX-2295	$2,412	12577	264	9	47.2	15	**17.5**	**7**	**96.1**	**11**	**51.3**	**7**
BTS-1606N	$2,400	12515	255	21	49.3	9	17.0	22	95.8	19	**50.0**	**9**
BTS-1703	$2,394	12480	265	6	47.1	16	**17.7**	**5**	95.8	20	41.1	23
MA-814	$2,382	12417	257	16	48.3	10	17.0	19	**96.1**	**10**	**55.0**	**2**
SX-2294	$2,375	12383	261	11	47.5	13	17.4	12	95.9	17	45.4	16
SX-2297	$2,368	12347	264	7	46.6	18	17.4	10	**96.5**	**4**	40.4	25
SX-2283	$2,344	12221	256	18	47.6	11	17.0	23	**96.3**	**8**	43.0	21
SX-2201	$2,336	12181	259	14	47.0	17	17.2	18	**96.0**	**14**	40.6	24
SX-2296N	$2,329	12143	**270**	**4**	45.2	21	**17.6**	**6**	**96.5**	**5**	43.9	20
HIL-2361	$2,310	12046	**270**	**3**	44.7	23	**17.8**	**3**	**96.3**	**7**	**48.6**	**12**
C-G752NT	$2,309	12038	255	23	47.3	14	17.2	16	95.3	23	44.4	19
SX-1278N	$2,276	11865	**268**	**5**	45.5	20	**17.7**	**4**	**96.7**	**1**	51.6	5
MA-709	$2,234	11647	257	15	45.8	19	17.2	15	96.0	15	41.8	22
HIL-2238NT	$2,185	11390	252	25	44.0	24	16.9	24	95.5	22	44.6	18
MA-813NT	$2,072	10805	256	19	42.4	25	17.2	13	95.3	25	**53.3**	**3**
Average	$2,412.7	12579.3	261		48.2		17.34		96.03		47.47	
LSD 5%	193.2	1007.2	10.1		3.5		0.6		0.6		7.8	
CV %	8.1	8.1	3.9		7.3		3.3		0.6		16.6	

Fungicide Application Dates: 6/23, 6/30, 7/14, 7/26, 8/5, 8/16, 8/30, 9/17

$/A: Payment calculated using early delivery adjustment where necessary, and a per pound payment of $0.1767.

Bold: Results are not statistically different from top-ranking variety in each column.

Comments: This trial was planted at 1.9" seed spacing and thinned to the equivalent of 200 beets/100' of row. Very dry conditions in April and May were followed by frequent and persistent rainfall in the month of June. The June weather promoted rapid canopy and root growth. Root yield and sugar content were very good in this trial compared to some others. Rhizoctonia was present in this trial at low to moderate levels in some varieties. Cercospora Leaf Spot was also present at harvest in levels that were near economic impact.

Plant to Stand

SVREC, Richville - 2021

Trial Quality: Good
Planted: April 14
Harvested: October 20
Plots: 6 Rows X 38 ft., 4 reps
Row Width: 22 in.
Seeding Rate: 4.1 in.

Soil Info: Clay Loam
% OM: 3.6 **pH:** 7.5 **CEC:** 16.7
P: Above Opt **K:** Above Opt
Mn: High **B:** Low
Prev Crop: Corn
Added N: 35 lbs. 2x2, 100 lbs. PPI

Disease Pressure:
Cerc: Low/Moderate
Rhizoc: Low/Moderate
Rainfall: 16.62 in.

Variety	$/A	RWSA	RWST		Yield		Sugar		CJP		B/100 ft	
			Lb/T	Rank	T/A	Rank	%	Rank	%	Rank	Act.	Rank
C-G675	**$2,493**	**12997**	**276**	**3**	**47.0**	**1**	**18.2**	**4**	**96.3**	**5**	**143.8**	**3**
C-G932NT	**$2,387**	**12445**	**272**	**7**	**45.7**	**3**	**18.1**	**7**	**95.9**	**15**	**126.1**	**11**
BTS-1065	**$2,344**	**12220**	**268**	**11**	**45.5**	**4**	**17.7**	**11**	**96.2**	**8**	**142.0**	**4**
BTS-1703	**$2,273**	**11849**	**272**	**8**	**43.5**	**9**	**18.2**	**3**	95.4	19	**111.4**	**16**
SX-2296N	**$2,247**	**11716**	**274**	**4**	**42.7**	**10**	**18.1**	**6**	**96.2**	**7**	**128.9**	**8**
SX-1278N	**$2,234**	**11646**	**274**	**5**	**42.6**	**11**	**18.1**	**5**	**96.1**	**11**	**129.1**	**7**
BTS-197N	**$2,201**	**11475**	**259**	**14**	**44.2**	**7**	**17.3**	**16**	**95.9**	**14**	**105.6**	**21**
SX-2297	**$2,194**	**11438**	**279**	**2**	**41.1**	**15**	**18.4**	**2**	**96.1**	**10**	92.5	23
BTS-1941	**$2,165**	**11287**	257	17	**43.8**	**8**	**17.6**	**12**	94.7	23	**108.6**	**20**
C-G943	**$2,163**	**11276**	254	19	**46.2**	**2**	**17.4**	**15**	95.0	22	**131.5**	**6**
BTS-1606N	**$2,162**	**11272**	253	21	**44.5**	**6**	16.8	20	**96.2**	**9**	**122.8**	**14**
C-G021	**$2,142**	**11167**	**262**	**13**	**42.4**	**12**	**17.4**	**13**	**95.9**	**16**	**110.8**	**18**
SX-2294	**$2,136**	**11137**	**274**	**6**	**40.7**	**18**	**17.9**	**9**	**96.8**	**2**	**125.0**	**13**
C-G752NT	**$2,121**	**11057**	248	22	**44.5**	**5**	16.8	21	95.4	18	**139.9**	**5**
HIL-9865	**$2,117**	**11039**	**269**	**10**	**41.1**	**14**	**17.7**	**10**	**96.4**	**4**	**126.1**	**10**
SX-2283	**$2,114**	**11023**	**281**	**1**	**39.1**	**19**	**18.5**	**1**	**96.3**	**6**	**113.1**	**15**
MA-814	**$2,047**	**10673**	**259**	**15**	**41.1**	**16**	17.1	19	**96.4**	**3**	**146.6**	**2**
C-G919	**$2,039**	**10629**	254	18	**41.7**	**13**	16.7	22	**96.8**	**1**	**125.2**	**12**
MA-709	$1,983	10337	253	20	**40.9**	**17**	**17.2**	**18**	95.1	21	101.5	22
SX-2295	$1,865	9722	**262**	**12**	37.5	20	**17.4**	**14**	**96.0**	**12**	**127.8**	**9**
HIL-2332NT	$1,813	9451	**270**	**9**	35.1	23	**18.0**	**8**	**95.7**	**17**	**111.2**	**17**
HIL-2238NT	$1,743	9086	244	23	37.2	21	16.6	23	95.1	20	**109.9**	**19**
MA-813NT	$1,739	9067	**258**	**16**	35.1	22	**17.2**	**17**	**95.9**	**13**	**152.4**	**1**
Average	$2,118.2	11044.0	264		41.9		17.57		95.90		123.12	
LSD 5%	383.5	1999.7	19.0		6.9		1.1		0.9		38.4	
CV %	12.8	12.8	5.1		11.6		4.5		0.7		22.1	

Fungicide Application Dates: 6/23, 6/30, 7/14, 7/26, 8/5, 8/16, 8/30, 9/17

$/A: Payment calculated using early delivery adjustment where necessary, and a per pound payment of $0.1767.

Bold: Results are not statistically different from top-ranking variety in each column.

Comments: Final stands in this trial were lower than desired. Overall root yield and sugar content were very good. Cercospora Leaf Spot and Rhizoctonia were both present in this trial at low to moderate levels depending on varietal tolerance.

Rhizoctonia Nursery

Average of 2 years, 2020 & 2021

Trial Quality: Good
Location: 2020 - SVREC, 2021 - SVREC
Plot Size: 2 Rows X 25 ft., 6 reps
Inoculation: Inoculated with Rhizoctonia Solani AG 2-2 IIIB

Variety	Root Rating* 0-7	Estimated Root Rot %
HIL-2361	5.1	53.8
SX-2297	5.2	56.3
HIL-2332NT	5.2	57.5
Resistant Check	5.3	58.8
C-G021	5.3	60.0
MA-709	5.3	60.0
C-G049	5.3	61.3
BTS-197N	5.4	61.3
SX-2295	5.4	62.5
C-G932NT	5.4	62.5
HIL-9865	5.4	62.5
SX-2296N	5.4	63.8
MA-814	5.5	65.0
C-G752NT	5.5	65.0
C-G919	5.5	65.0
BTS-1703	5.5	66.3
BTS-1941	5.6	66.3
BTS-1606N	5.6	66.3
C-G675	5.6	66.3
Susceptible Check	5.6	66.3
SX-2283	5.6	67.5
MA-813NT	5.7	70.0
SX-1278N	5.8	71.3
HIL-2238NT	5.8	72.5
BTS-1065	5.8	72.5
SX-2201	5.8	72.5
SX-2294	5.9	75.9
Average	5.50	64.75
LSD 5%	0.8	18.6
CV %	6.8	14.0

Bold: Results are not significantly different from the top ranking variety in each column

***Rating System:**

0 = No Infection 1 = less than 2% rotted roots 2 = less than 5% rotted roots
3 = 5 to 25% rotted roots 4 = 26 to 50% rotted roots 5 = 51 to 75% rotted roots
6 = 76 to 95% rotted roots 7 = 100% rotted roots

During evaluations, roots were dug and assigned values from 0 to 7. Each plot contained approximately 50 roots and each root was rated.

Cercospora Nursery

Average of 2 years, 2020 & 2021

Trial Quality: Good

Locations:

2020 - Gilford, SVREC

2021 - Blumfield East, SVREC

Inoculation: Trials were Inoculated

Plot Size:

Gilford - 2 Rows X 17.5 ft., 5 reps

SVREC 2020 - 2 Rows X 20 ft., 5 reps

Blumfield East - 2 Rows X 25 ft., 6 reps

SVREC 2021- 2 Rows X 20 ft., 6 reps

Variety	Avg of 2 Years CLS Rate 0-9	2020 CLS Rate 0-9	2021 CLS Rate 0-9
BTS-1941	1.8	1.8	1.7
C-G021	1.9	2.0	1.7
BTS-1065	2.1	2.2	2.0
C-G049	2.1	2.3	2.0
C-G919	3.1	3.3	3.0
BTS-1703	3.4	3.5	3.4
MA-813NT	3.7	3.6	3.8
SX-2201	3.7	4.0	3.4
SX-2294	3.8	4.0	3.7
MA-709	3.9	4.0	3.7
SX-2297	3.9	3.9	3.9
HIL-2361	3.9	4.0	3.9
SX-2283	3.9	4.2	3.7
Resistant Check	3.9	4.1	3.8
SX-2295	4.0	4.0	4.0
MA-814	4.0	4.1	3.9
C-G675	4.0	4.2	3.9
HIL-2238NT	4.1	4.1	4.0
BTS-1606N	4.2	4.4	4.0
HIL-9865	4.3	4.3	4.3
C-G752NT	4.4	4.6	4.1
SX-2296N	4.5	4.6	4.5
C-G932NT	4.5	4.8	4.3
Susceptible Check	4.5	4.9	4.2
HIL-2332NT	4.6	4.6	4.6
SX-1278N	4.7	4.9	4.5
BTS-197N	4.8	5.0	4.6
Average	3.77	3.88	3.64

Cercospora Rating (0-9 Scale): 0 = no spots, 1 = very few spots, 2 = up to 10 spots/leaf, 2.5 = up to 50 spots/leaf, 3 = 100 to 200 spots/leaf (approx 3% leaf injury), 4 = up to 10 % injury, 5 = up to 25 % injury, 6 = up to 50% injury, 7 = up to 75% injury, 8 = up to 90% injury, 9 = leaves completely dead.

Comments: Trials are inoculated at or near row closure. Ratings begin when susceptible varieties are at economic impact levels. Entries in the trial are coded except the observation replication which are not used for rating purposes. All varieties will develop leafspot beyond economic impact in these trials.

Sugar beet activities of the USDA-ARS East Lansing, 2021 as the SVREC

Linda Hanson, Tom Goodwill, and Holly Corder.

Evaluations and rating plots were planted at the Saginaw Valley Research and extension Center (SVREC) in Frankenmuth, MI in 2021 that focused on Cercospora leaf spot, Alternaria leaf spot, and Rhizoctonia root and crown rot disease performance of a range of *Beta vulgaris*.

For Rhizoctonia root and crown rot, all assessment in 2021 was on adult-plant response. Over 200 commercial entries were evaluated in the nursery. The field was planted May 10, inoculated with dried, ground barley inoculum of *Rhizoctonia solani* AG 2-2 on July 20, and harvested and evaluated for disease severity August 23-25. A 0-7 rating scale where 0=no root rot symptoms and 7=root completely rotten was used. A stand count was taken in July and beets that were missing at the rating in August were classified as 7s. A disease index was calculated based on the weighted average ratings, and the percent of beets that would be considered healthy (rating or 0 or 1) or harvestable (less than 25% of the root rotted) were calculated for each entry. Most of these were coded and information was provided to the companies. The susceptible and resistant controls differed significantly in the percent of healthy and harvestable beets (Table 1).

Table 1. Disease response across the 2021 Rhizoctonia root and crown rot nursery for response to inoculation with *R. solani* AG 2-2 in a susceptible and resistant beet variety. Values for each category were significantly different by Fishers protected LSD at p>0.05.

BEET	AVG DISEASE INDEX	AVG % HEALTHY	AVG. % HARVESTABLE
SUSCEPTIBLE	5.8	0.2	8.9
RESISTANT	4.9	2.0	27.5

For Cercospora leaf spot, beets were planted on May 6. Beets were inoculated with a liquid spore suspension on July 12. The suspension was prepared by soaking leaves with Cercospora leaf spot in distilled water. Leaves had been collected in 2020, dried, and stored at 4 C. A spore count was taken and inoculum was applied at approximately 10^3 spores per ml. Disease was severe enough to rate starting August 12, 2021, about a week later than has been usual in the nursery. Ratings were taken until regrowth started to outpace new disease development. At the final rating, the susceptible and resistant controls averaged ratings of 6.3 and 3.5 respectively. This is on a 0-10 scale where 0 is no visible disease and 10 is plants completely defoliated.

Thirty Plant Introductions from the National Plant Germplasm system were screened in the nursery, the area under the disease progress steps (AUDPS, Simko and Piepho 2012) was used to examine the response of the materials. One entry had no plants emerge. One entry, PI 9, was not significantly different from the resistant control. Data is sent to the national plant germplasm system and made available to breeders.

Table 1. Response of Plant Introduction entries to Cercospora leaf spot in the 2021 nursery at SVREC. Plots were rated weekly using a 0-10 scale where 0 is no visible spots and 10 is plants completely defoliated. Shown is the average rating for four replicates for each entry and the area under the disease progress stairs (AUDPS) for the entire rating period. The lower the number, the less severe the disease.

entry	Final rating	AUDPS
susceptible	6.3	18.8
resistant	3.5	10.5
PI1	4.3	12.8
PI10	4.3	12.8
PI11	4.0	12.0
PI12	5.8	17.3
PI13	5.5	16.5
PI14	5.8	17.3
PI15	4.8	14.3
PI16	5.3	15.8
PI17	6.3	18.8
PI18	5.3	15.8
PI19	5.0	15.0
PI2	5.3	15.8
PI20	no plants	no plants
PI21	4.5	13.5
PI22	4.8	14.3
PI23	4.3	12.8
PI24	5.5	16.5
PI25	4.0	12.0
PI26	4.3	12.8
PI27	4.0	12.0
PI28	4.3	12.8
PI20	5.5	16.5
PI3	4.0	12.0
PI30	5.0	15.0
PI4	6.7	20.0
PI5	5.3	16.0
PI6	5.0	15.0
PI7	4.3	12.8
PI8	4.7	14.0
PI9	3.5	10.5

Evaluation of in-furrow and banded fungicide applications to manage Rhizoctonia root and crown rot, 2021

Chris Bloomingdale and Jaime Willbur, Michigan State University

Location: Frankenmuth (SVREC)	**Treatment Timings:** In-Furrow & Banded (6-8 leaf stage)
Planting Dates: May 11, 2021	**Pesticides:** see table
Soil Type: Loam	**O.M.:** 5.0 **pH:** 7.5
Replicates: 4	**Sugar Beet Variety:** SX-2283

Summary: Significant Rhizoctonia root rot pressure was observed uniformly throughout the study. Treatments significantly impacted percent stand loss ($P < 0.0001$), and all fungicide programs had significantly lower stand loss than the inoculated control. Significant differences were also observed among root disease index ratings ($P < 0.01$) and yield ($P < 0.05$). Root rot pressure significantly limited yield potential, and treatment yields were considered relative to the non-inoculated, non-treated control.

Table 1. End of season stand loss, Rhizoctonia root rot index, and yield from the tested fungicide programs.

No.	Treatment, Rate[a]	Application Type[b]	Stand Loss (%)[c]	Disease Index (%)[d]	Yield (t/A)	Relative Yield (%)[e]
7	Elatus, 7.1 oz Elatus, 7.1 oz	In-Furrow Banded	6.1 d	7.9 c	11.1 a-c	75.4
10	Excalia, 2.0 fl oz	Banded	6.7 d	9.8 c	13.0 a-c	88.1
5	Quadris, 13.9 fl oz Quadris, 13.9 fl oz	In-Furrow Banded	7.6 cd	7.3 c	16.7 a	113.2
6	Quadris, 13.9 fl oz Elatus, 7.1 oz	In-Furrow Banded	8.3 cd	12.4 c	17.9 a	121.0
1	Non-Inoculated Control[f]	-	9.8 cd	21.1 bc	14.8 ab	100.0
11	Quadris, 13.9 fl oz Growthful, 1.0 pt Quadris, 13.9 fl oz Growthful Post, 12.8 fl oz	In-Furrow In-Furrow Banded Banded	21.6 b-d	15.8 c	12.8 a-c	86.6
9	Quadris, 12.0 fl oz	Banded	31.8 bc	30.3 c	7.1 b-d	48.3
4	Minuet, 12.8 fl oz Quadris, 9.2 fl oz Proline, 5.7 fl oz	In-Furrow In-Furrow Banded	37.6 b	17.0 bc	6.1 cd	41.2
8	Quadris, 13.9 fl oz Proline, 5.7 fl oz	In-Furrow Banded	41.3 b	40.4 ab	10.7 a-c	72.4
3	Quadris, 9.2 fl oz Proline, 5.7 fl oz	In-Furrow Banded	42.6 b	22.3 bc	6.3 b-d	42.9
2	Inoculated Control[f]	-	75.1 a	56.6 a	1.1 d	7.5

[a] All rates are listed as measure of a product per acre.
[b] In-furrow treatments were applied at planting (11 May), banded applications were applied at the 6-8 leaf stage (22 Jun).
[c] Stand loss percentages calculated from initial stand counts collected Jul 20 and final dead beet counts collected Aug 17. Column values followed by the same letter were not significantly different based on Fisher's Protected LSD (α=0.05).
[d] Disease index was calculated by multiplying the Rhizoctonia root rot incidence (0-100%) by the mean symptomatic root severity (1-7) and dividing by 7.
[e] Relative yield estimated from mean yields for each treatment and the non-inoculated, non-treated control.
[f] Non-treated control.

Evaluation of foliar fungicides to manage Cercospora leaf spot of sugar beet in Michigan, 2021

Chris Bloomingdale and Jaime Willbur, Michigan State University

Location: Frankenmuth (SVREC)	**Treatment Timings:** 14-day interval starting at 35 DSV
Planting Dates: May 7, 2021	**Pesticides:** see table
Soil Type: Loam	**O.M.:** 5.0 **pH:** 7.5
Replicates: 4	**Variety:** SX-2296N

Summary: Significant differences in area under the disease progress curve (AUDPC) were observed in this trial ($P < 0.0001$). All fungicide programs had significantly lower disease severity than the non-treated control. The lowest AUDPC values were observed in programs 7 and 11, however, these did not perform differently than half of the other tested programs. Significant differences were observed in estimated yield values for programs ($P < 0.0001$). Values ranged between 16.8 and 25.7 t/A, and 10 of the 20 programs had significantly greater yields than the non-treated control. Differences were also observed in the percent sugar ($P < 0.0001$) and RWST values ($P < 0.0001$).

Table 1. Area under the disease progress curve (AUDPC) and yield parameters from the tested fungicide programs.

No.	Treatment, Rate[a], and Timing[b]	AUDPC[c, d]	Yield (t/A)	Sugar (%)	RWST[e]
1	Non-treated Control	103.8 a	19.8 e-g	15.0 g	216.5 f
6	Provysol (2.5 fl oz) ABCDE	80.5 b	17.3 fg	15.1 fg	217.0 f
12	Luna Flex (13.7 fl oz) ABCDE	57.0 c	16.8 g	15.8 d-f	229.5 d-f
13	Koverall (2 lb) ABCDE; Lucento (5.5 fl oz) B; Super Tin (8 fl oz) CE; Topsin (20 fl oz) C; Provysol (4 fl oz) D	56.5 c	24.3 a-d	16.4 a-e	239.0 a-e
8	Proline (5.7 fl oz) ABCDE	56.3 c	25.3 ab	16.2 a-e	234.8 a-e
5	Inspire XT (7 fl oz) ABCDE	54.0 c	22.1 b-e	16.2 b-e	235.9 a-e
17	Koverall (1.5 lb) ABDE; Sipcam TPTH (8 fl oz) ACE; Minerva (13 fl oz) B; Spinnaker (1.5 lb) C; Inspire XT (7 fl oz) D	53.8 cd	24.0 a-d	16.9 a	247.3 a
14	Koverall (2 lb) ABCDE; Lucento (5.5 fl oz) B; Super Tin (8 fl oz) CE; Topsin (20 fl oz) C; Proline (5 fl oz) D	51.0 cd	24.5 a-d	16.5 a-d	243.0 a-d
16	Manzate Max (1.6 qt) ABCDE; Eminent (13 fl oz) B; Super Tin (8 fl oz) CE; Provysol (5 fl oz) D	51.0 cd	21.5 de	16.8 ab	245.1 ab
19	Cercos (23 fl oz) AC; Sipcam TPTH (8 fl oz) ACE; Koverall (1.5 lb) BDE; Minerva (13 fl oz) B; Inspire XT (7 fl oz) D	50.8 c-e	22.7 a-e	16.6 a-c	243.8 a-c
2	Manzate Max (1.6 qt) ABCDE; Inspire XT (7 fl oz) BD; Super Tin (8 fl oz) CE	47.8 c-f	21.1 c-f	16.1 b-e	234.1 b-e
3	Growthful Post (3.5 fl oz) banded; Manzate Max (1.6 qt) ABCDE; Growthful Post (12.8 fl oz) ABCDE; Inspire XT (7 fl oz) BD	45.0 c-f	21.9 c-e	15.7 e-g	227.7 ef
15	Badge (2 PT) ABCDE; Eminent (13 fl oz) B; Super Tin (8 fl oz) CE; Provysol (5 fl oz) D	45.0 c-f	24.4 a-d	16.7 ab	243.4 a-d
18	Koverall (1.5 lb) ABDE; Minerva (13 fl oz) B; Sipcam TPTH (8 fl oz) CE; Miramar (21.8 fl oz) C; Inspire XT (7 fl oz) D	42.0 c-f	25.7 a	16.5 a-d	240.8 a-d

No.	Treatment, Rate[a], and Timing[b]	AUDPC[c, d]		Yield (t/A)		Sugar (%)		RWST[e]	
20	Cercos (23 fl oz) AC; Minerva (13 fl oz) A; Sipcam TPTH (8 fl oz) BD; Koverall (1.5 lb) BDE; Inspire XT (7 fl oz) C	42.0	c-f	22.6	a-e	16.1	b-e	232.9	b-e
10	Delaro (11 fl oz); Proline (1.71 fl oz) ABCDE	36.0	d-f	24.5	a-d	16.6	a-d	244.4	a-c
9	Propulse (13.6 fl oz) ABCDE	33.0	ef	25.1	a-c	16.6	a-c	242.6	a-d
4	Experimental 1 (10.8 fl oz) ABCDE	32.8	f	23.7	a-d	16.2	a-e	236.5	a-e
7	Experimental 2 (12 fl oz) ABCDE	30.0	f	21.5	de	16.0	c-e	231.6	c-e
11	Delaro Complete (11 oz) Proline (1.71 fl oz) ABCDE	30.0	f	25.7	a	16.7	ab	244.5	ab

[a] All rates, unless otherwise specified, are listed as a measure of product per acre. MasterLock was added to all tank mixes at a rate of 0.25 % v/v.

[b] Application letters code for the following dates: banded=22 Jun, A=6 Jul, B=20 Jul, C=3 Aug, D=17 Aug, E=2 Sep.

[c] Area under the disease progress curve was calculated using disease severity scores (0-10 scale) collected Jul 1, Jul 23, and Aug 16.

[d] Column values followed by the same letter were not significantly different based on Fisher's Protected LSD (α=0.05).

[e] Pounds of recoverable white sugar per ton of beets.

Strategies for improved management of Cercospora leaf spot on sugar beets, 2020-2021

Alexandra Hernandez[1], Daniel Bublitz[1], Tom Wenzel[1], Chris Bloomingdale[1], Cameron Pincumbe[1] Sarah Ruth[1], Cheryl Trueman[2], Linda E. Hanson[1,3], and Jaime F. Willbur[1]; [1]Michigan State University; [2]University of Guelph – Ridgetown; [3]USDA–ARS

Background: This research aims to identify, develop, and deploy novel, short-term and long-term CLS management strategies. Observations of *C. beticola* survival over the winter, early-season inoculum and spore presence, and disease pressure overtime have helped us to identify opportunities for further improvement in CLS management. Disease prediction tools were investigated to create an innovative spore abundance model to aid in CLS management. End-of-season management strategies were assessed to reduce *C. beticola* inoculum levels and CLS disease pressure in the field.

Methods:

Objective 1: **Monitor *C. beticola* spore presence and abundance using spore traps and sentinel beets to refine existing predictive modeling tools.** Early season aerial spores were captured using Burkard spore traps and highly susceptible sentinel beets (germplasm F1042) at: the MSU Crop and Soils Farm and Frankentrost, MI in 2019; Ontario, Canada in 2019 and 2021; and the Saginaw Valley Research and Extension Center (SVREC) in 2020 and 2021. Environmental factors were monitored using on-site or local MSU Enviroweather stations and evaluated for correlations to spore abundance. Stepwise regression and logistic modeling analyses were conducted to assess the accuracy of the model variables separately, together, and as 2-, 3-, 4-, and 5-day moving averages and sums.

Objective 2: Implement novel strategies to improve Cercospora leaf spot management by reducing inoculum overwintering.

Location: Saginaw (SVREC)	**Treatments:** described below
Planting Date: May 7, 2021	**Variety:** C-G932NT (Inoculated Jul 9 and Jul 23, 2020)
Harvest: Sep 17, 2021	**Replicates:** 4

From 2020-21, experiments were repeated to evaluate the following fall treatments: 1) nontreated control, 2) plow immediately post-harvest, 3) heat treatment at 1 mph prior to defoliation at-harvest, 4) desiccant (saflufenacil) 7 days pre-harvest, and 5) heat treatment at 3 mph. In 2020, treatments were applied to 10 x 60 ft plots, surrounded by a 10-ft buffer of winter wheat followed by soybean, and replicated four times in a randomized complete block design. Leaf samples were collected from each plot at harvest before topping and evaluated 0-, 45-, 90-, and 135-days post-harvest (DPH) to assess *C. beticola* survival over the winter, determined using the percentage of lesion sporulation and isolation frequency from treated leaves. Leaf degradation over time was also evaluated.

In 2021, highly susceptible sentinel beets (germplasm F1042) and bi-weekly CLS ratings in re-planted plots were used to assess the efficacy of inoculum reduction strategies. Yield and sugar data were collected to assess the long-term efficacy of inoculum reduction strategies. Statistical analyses (mixed model ANOVA) were conducted in SAS v. 9.4 and evaluated at the α=0.05 significance level. Fisher's protected Least Significance Difference was used for mean comparisons.

Results & Conclusions:

Objective 1: Logistic modeling analyses using spore thresholds of 10, 35, 50, and 100 spores have been conducted on data all locations 2019 and 2020 with raw environmental data, as well as 2- through 5-day

moving averages and sums. Significant correlations were detected at all thresholds for 2-, 3-, 4-, and 5-day moving averages and sums of average relative humidity ($P < 0.05$) (Table 1).

Table 1. Weather variables significantly correlated with binary aerial spore presence and absence data, determined from aerial spore thresholds.

Preliminary aerial spore threshold[a]	Significantly correlated variables ($P < 0.05$)
10	2- to 4-day moving sums of maximum wind speed 4- to 5-day moving averages of maximum wind speed 5-day moving averages (and sums) of minimum air temperature 5-day moving averages (and sums) of mean air temperature 5-day moving averages (and sums) of mean relative humidity
35	3- to 5-day moving averages of maximum wind speed
50	3- to 5-day moving averages of maximum wind speed

[a] Binary spore values for logistic regression analyses were determined from the daily aerial spore counts. Counts greater than the threshold number were assigned a 1 (present) and those equal to or less than this number were assigned a 0 (absent).

Preliminary model validation field trials were conducted 2021 by testing three different initial spray times: 27 DSV (Jun 17), 34 DSV, (Jun 22), and 56 DSV (Jul 1). The same fungicide program was applied to resistant and susceptible beet varieties: Manzate Max 1.6 qt/a (A-F), Inspire XT 7 fl oz/a (BD), Super Tin 8 fl oz/a (C). MasterLock 0.25% (v/v) was included in all applications. Treatments were applied every two weeks after initiation. Analyses of validation trial and spore data from 2021 and model refinement using 2019, 2020 and 2021 data are in-progress. A predictive model that can capture times of peak spore levels will complement existing tools to better predict early-season risk and improve subsequent CLS management.

Objective 2: In 2020 (following treatment application), significant differences were detected in percent lesion sporulation at-harvest ($P < 0.0001$, Fig. 1A), 45-DPH ($P < 0.01$, Fig 1B), and 90-DPH ($P < 0.05$, Fig. 1C) samples (N=160 leaves and 200 lesions per timepoint). No differences were detected in isolation frequencies of *C. beticola* from leaf samples evaluated at-harvest, 45-, 90-, and 135-DPH. Additionally, no differences were observed in percent sugar or RWST. Significant differences in percent leaf degradation, calculated using initial leaf weight at-harvest and final weight post-harvest, were detected in 90- ($P < 0.05$) and 135-DPH ($P < 0.01$) leaf samples. In 2021 (the year following treatment application), both heat treatments resulted in significantly fewer lesions on sentinel beets from June 1-8 ($P < 0.05$, Fig. 2A) and the 1 mph heat treatment resulted in significantly fewer lesions on sentinel beets June 15-22 ($P < 0.05$, Fig. 2B) compared to the non-treated control (N=60 beets per timepoint). Area under the disease progress curve (AUDPC) values were significantly different among treatments ($P < 0.01$, Fig. 2C); the plow and heat treatments resulted in significantly lower CLS than the non-treated control. Results from repeated experiments (2019-20 and 2020-21) consistently suggest the use of a foliar burner at-harvest has the potential to significantly reduce inoculum overwintering and CLS levels the following year.

An additional trial is in-progress to evaluate the following additional fall treatments: 'Wheeler' rye cover crop at 67 kg/ha planted immediately post-harvest, factory lime at 3 and 6 tons/acre applied immediately post-harvest, and heat treatment at 3 mph prior to defoliation. Evaluations will continue into the 2022 growing season.

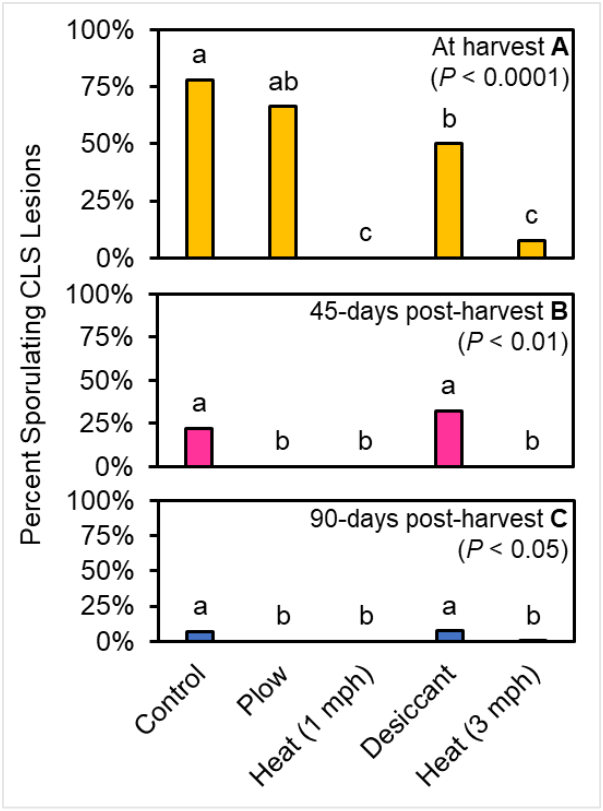

Figure 1. A) *At-harvest,* ***B)*** *45-, and* ***C)*** *90-day post-harvest lesion sporulation following fall treatments applied in 2020. Leaf samples from each treated plot were placed in a moist chamber for three days. Then CLS lesions were assessed by observing characteristic C. beticola sporulation under a stereomicroscope (X7-X30 magnification). Means of bars with the same letters were not different based on Fisher's protected LSD at α=0.05.*

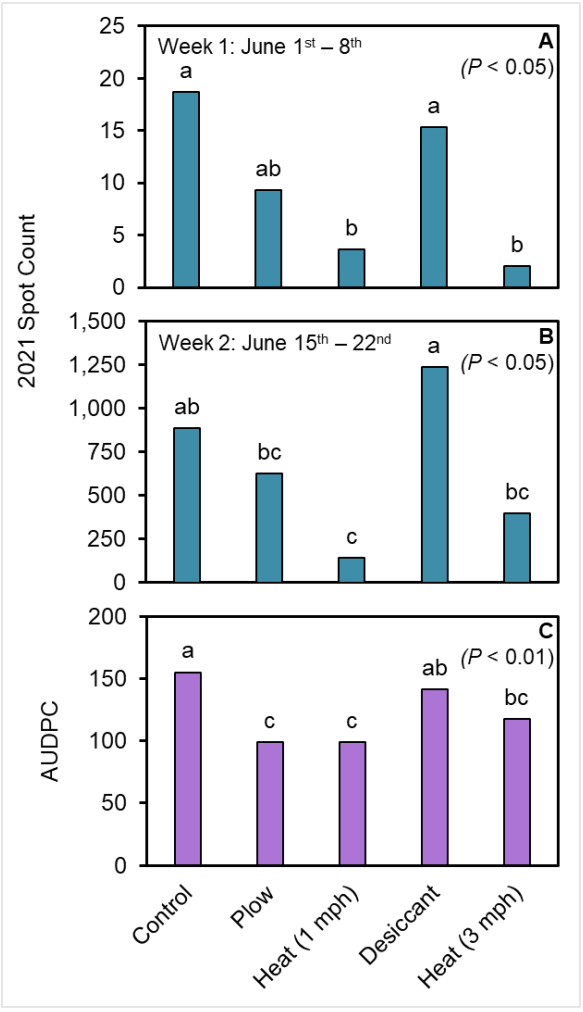

Figure 2. *Early-season inoculum and subsequent CLS observations in 2021 following end-of-season treatments applied in 2020.* ***A-B)*** *Spot counts were collected from four sentinel beets placed in the center of each treated plot, left for seven days, incubated in a moist chamber for 3 days, and kept in a greenhouse for 21 days to promote symptom development.* ***C)*** *Area under the disease progress curve (AUDPC) generated from CLS ratings (0-10 scale) collected 15 Jun to 10 Aug. Means of bars with the same letters were not different based on Fisher's protected LSD at α=0.05.*

Acknowledgements: This work is supported by the Michigan Sugar Company, USDA-ARS, Project GREEEN, Sugarbeet Advancement, and the USDA National Institute of Food and Agriculture, Hatch project 1020281.

Evaluation of Cercospora leaf spot and postharvest rot pathogen impacts on sugarbeet storage, 2020-21

Carly Hendershot[1], Chris Bloomingdale[1], Holly Corder[1], Tom Goodwill[2], Sarah Ruth[1], Cameron Pincumbe[1], Randy Beaudry[1], Linda E. Hanson[1,2], and Jaime F. Willbur[1]; [1]Michigan State University; [2]USDA-ARS

Trial 1: CLS infection impact on susceptibility of sugarbeet to four postharvest diseases

Location: Saginaw (SVREC)	**Treatments:** Non-treated (high CLS), grower standard (low CLS)
Planting Date: April 7, 2020	**Variety:** C-G333NT (Inoculated July 9 and July 23, 2020)
Harvest: September 18, 2020	**Replicates:** 4 plots/treatment in field, 3 roots/plot in storage

Trial 2: CLS inoculation and variety impacts on susceptibility of sugarbeet to four postharvest diseases

Location: Saginaw (SVREC)	**Treatments:** Inoculated (high CLS), non-inoculated (low CLS)
Planting Date: May 22, 2020	**Varieties:** F1042, EL50/2, C-G333NT, HIL-9865
Harvest: October 15, 2020	**Inoculated:** July 9 and July 23, 2020

Objective 1: Evaluate the impacts of variety and Cercospora leaf spot (CLS) field infection on rate of storage rot symptom development. CLS was rated on the KWS scale of 0 (disease-free) to 10 (foliage dead). At time of harvest, non-treated beets had an average rating of 5.44 (classified as high CLS) and treated beets averaged 2.34 (low CLS). Beets were harvested by hand and stored at 7 °C in plastic bags with wood shavings. Healthy beets of each variety were removed from storage every 4 weeks, washed, and cut into approximately 3-cm thick sections. Root sections were inoculated with a known storage rot pathogen or with a sterile potato dextrose agar (PDA) plug as a control. There were four replications of each variety x pathogen combination. Based on 2019-20 samples, *Penicillium vulpinum*, *Botrytis cinerea*, *Geotrichum* sp. and *Fusarium graminearum* were chosen for storage trials (REACh, 2020). Inoculated beets were incubated for 24 hours before removal of agar plugs, and after one week at ambient temperature, the lesion length and depth were measured and compared across varieties. Four timepoints were completed at 30, 90, 120 and 150 days postharvest.

Summary: Results show no evidence that CLS levels in the field affect rot development in storage for *Botrytis cinerea, Fusarium graminearum, Geotrichum* spp. or *Penicillium vulpinum* for the varieties tested. There were no significant differences between rot susceptibility in beets with high or low CLS in the field at any timepoint among the four varieties ($P > 0.05$, Figure 1). In trial 2, no significant effects were observed between CLS severity and rot diameter or depth at any timepoint ($P > 0.05$, data not shown). For all trials, lesions formed by *Geotrichum* sp. were not statistically different from the control ($P > 0.05$); additional screening will be conducted to assess diversity and aggressiveness. There were significant varietal differences in lesion development across the various pathogens at all storage timepoints ($P < 0.05$, Figure 2).

The relationship between beet variety and storage pathogen symptom development on beet root response to storage pathogens will be evaluated again during storage 2021-22. Depending on results from 2021-22 experiments, additional investigations of CLS impacts on beet storability may also be conducted. In 2022-23, varieties of interest are: EL-A18-0002, EL-A021482, C-G932NT and HIL-9865, with storage pathogens *B. cinerea*, *F. graminearum*, and *P. vulpinum*.

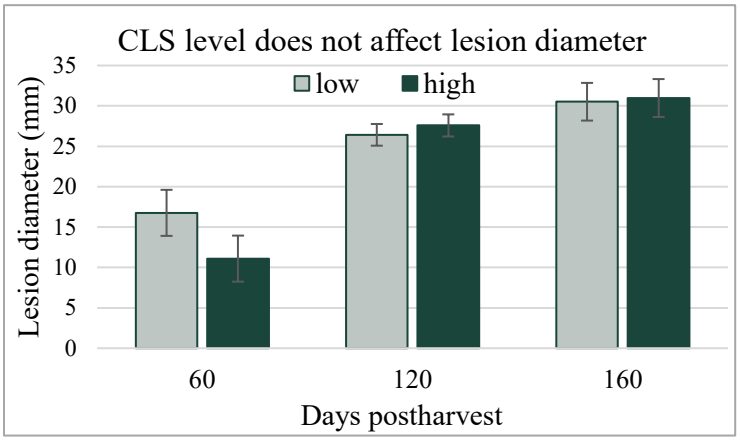

Figure 1: **Mean lesion diameters measured from trial 1 roots inoculated with postharvest pathogens 160 days postharvest (n=54 beet slices per treatment).**

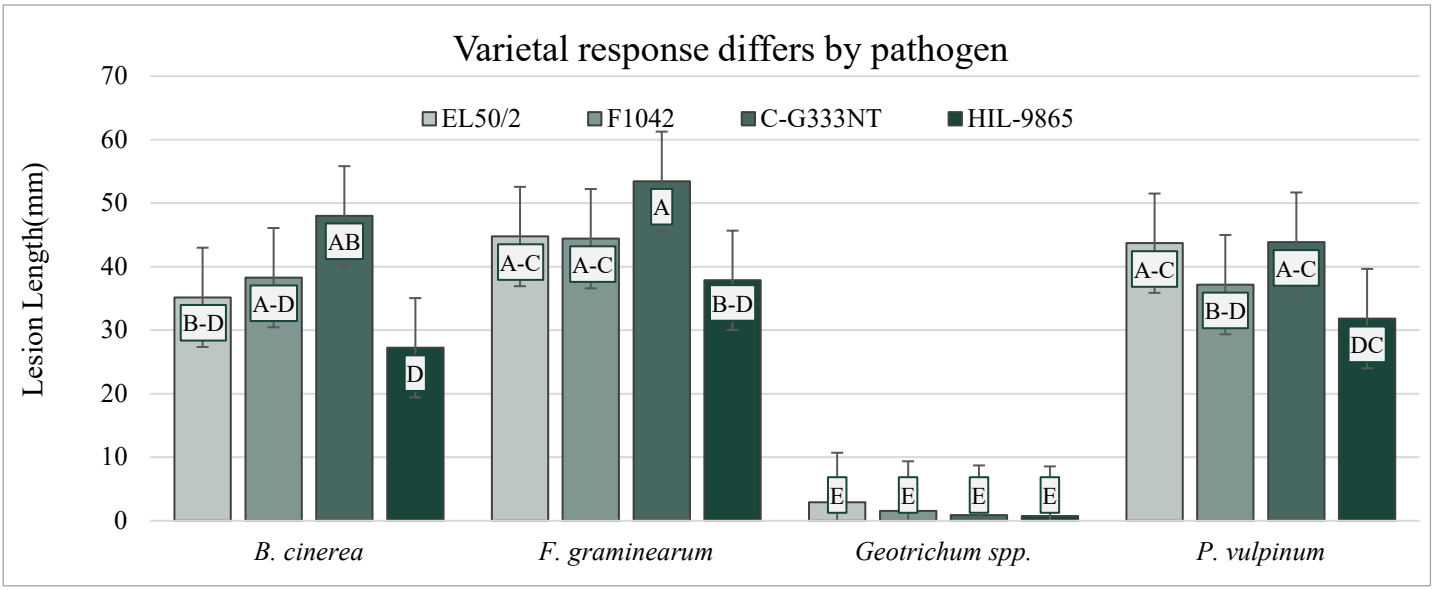

Figure 2: **Mean lesion diameter on roots of 4 varieties inoculated with storage pathogens 160 days postharvest (n=8 variety x pathogen replications per timepoint).**

Objective 2: Investigate the effect of CLS infection and post-harvest rot on beet respiration rate in storage. The effect of in-season CLS severity on storage respiration was also evaluated in collaboration with Dr. Randolph Beaudry. Roots of C-G333NT and HIL-9865 with high and low CLS levels were stored in vented respirometry chambers at 6°C/42°F. These beets were not inoculated with storage pathogens. Samples were taken monthly throughout the storage season to measure respiration rate (mL CO_2/kg/hr).
A preliminary inoculated respiration trial was completed using the Objective 2 beet varieties. Beets were inoculated at the crown by removing a 4-mm plug of beet tissue, inserting a 4-mm plug of 7-10 day old *P. vulpinum* or PDA control, replacing the beet plug, and sealing with petroleum jelly. Respiration was measured weekly for two months.

Summary: There was no difference in rate of respiration per kilogram of beet weight between beets with high and low CLS in the field ($P > 0.05$), although there was a difference in respiration rate among varieties. We will continue to evaluate the difference in varietal respiration in the future. Preliminary results show beets inoculated with *P. vulpinum* had a significantly increased respiration rate ($P < 0.05$), but no difference between high and low CLS levels ($P > 0.05$, Figure 4). In 2021-22, beets of variety C-G932NT with high and low CLS levels were placed in respirometry chambers as described above. These beets were inoculated at the crown with *F. graminearum, P. vulpinum, B. cinerea* or a PDA control in the method described previously. The respiration rate will be measured weekly throughout the storage season to examine the effects of storage pathogen infection on beet respiration.

Acknowledgements: This work is supported by the Michigan Sugar Company, USDA-ARS, Beet Sugar Development Foundation, and Project GREEEN. We also thank Dennis Bischer, Corey Guza, and Michigan Sugar Company agronomists for their assistance in obtaining beet root samples.

[1] Campbell, L. G. 2015. PI 674103, *Beta vulgaris* L. subsp. *vulgaris*. U.S. National Plant Germplasm System. https://npgsweb.ars-grin.gov/gringlobal/accessiondetail?id=1923721 ; [2] McGrath, J.M. 2012. Germplasm releases: EL50/2; EL58 through EL66; SR99 through SR101 [CD-ROM]. 2012 Annual Beet Sugar Development Foundation Research Report. Denver, Colorado: Beet Sugar Development Foundation

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Utilizing Boron to Improve *Cercospora beticola* Resistance

Lacie Thomas, Jaime Willbur, Daniel Bublitz, and Kurt Steinke, Michigan State University

See soil.msu.edu for more information

Location: Saginaw Valley Research and Extension Center	**Tillage**: Conv., 30-in. row
Planting Date: May 7, 2021 (Harvest 10/20/21)	**N Rates**: See below
Soil Type: Clay loam; 2.8% OM; 6.2 pH; 22 ppm P (Olsen P); 178 ppm K	**Population**: 4 in. spacing
Variety: C-G932NT	**Replicated**: 4 replications

Table 1. Field trial treatments evaluating three rates of foliar boron on sugarbeet yield, quality, and resistance to *C. beticola.*

Treatment	Product Rate† and Timing‡
Grower Standard Fungicide	Manzate Max (1.6 qt) ABCDEFG + Inspire XT (7 fl oz) BEG + Super Tin (8 fl oz) CF + Priaxor (8 fl oz), Topsin (20 fl oz) D + Badge (2 pt) H
Foliar Boron – Low No Fungicide	SprayBor (0.1 lb) ABCDEFGH
Foliar Boron – Medium No Fungicide	SprayBor (0.25 lb) ABCDEFGH
Foliar Boron – High No Fungicide	SprayBor (0.5 lb) ABCDEFGH
Grower Standard + Foliar Boron Low	SprayBor (0.1 lb) ABCDEFGH +Manzate Max (1.6 qt) ABCDEFG + Inspire XT (7 fl oz) BEG + Super Tin (8 fl oz) CF + Priaxor (8 fl oz), Topsin (20 fl oz) D + Badge (2 pt) H
Grower Standard + Foliar Boron Medium	SprayBor (0.25 lb) ABCDEFGH +Manzate Max (1.6 qt) ABCDEF + Inspire XT (7 fl oz) BEG + Super Tin (8 fl oz) CF + Priaxor (8 fl oz), Topsin (20 fl oz) D + Badge (2 pt) H
Grower Standard + Foliar Boron High	SprayBor (0.5 lb) ABCDEFGH +Manzate Max (1.6 qt) ABCDEF + Inspire XT (7 fl oz) BEG + Super Tin (8 fl oz) CF + Priaxor (8 fl oz), Topsin (20 fl oz) D + Badge (2 pt) H
Check	No Fungicide, No Foliar Boron

†All rates, unless otherwise specified, are listed as a measure of product per acre.
‡Application letters code for the following dates: A=28 Jun, B=12 Jul, C=26 Jul, D=5 Aug E= 16 Aug F= 25 Aug G= 9 Sept H= 27 Sept.

Table 2. Sugarbeet 2021 yield, recoverable sugar per acre (RWSA), recoverable sugar per ton (RWST), sugar %, and clear juice purity (CLP).

Treatment	Tons/A	RWSA	RWST	% Sugar	% CJP
Grower Standard Fungicide	39.8 a	9599 a	241 a	16.4 a	94.9
Foliar Boron – Low (FBL), No Fungicide	24.2 c	4976 c	205 b	14.2 b	94.5
Foliar Boron – Medium (FBM), No Fungicide	20.0 d	4078 c	202 b	14.0 b	94.2
Foliar Boron – High (FBH), No Fungicide	23.3 cd	4757 c	204 b	14.2 b	94.7
Grower Standard + FBL	36.9 ab	8962 ab	243 a	16.4 a	94.5
Grower Standard + FBM	34.6 b	7996 b	232 a	15.8 a	94.7
Grower Standard + FBH	34.1 b	8741 ab	241 a	16.3 a	95.0
Check - No Fungicide, No Boron	24.1 cd	4930 c	205 b	14.2 b	94.5
Pr > F	< 0.01	< 0.01	< 0.01	< 0.01	NS

†Values followed by the same lowercase letter are not significantly different at (α=0.1).

Table 3. Gross grower payment and profitability analysis less trucking cost.

Treatment	Gross Grower Payment ($/A)	Net Economic Return Minus Trucking‡ ($/A)
Grower Standard Fungicide	1004 a	855 a
Foliar Boron – Low (FBL), No Fungicide	520 c	430 c
Foliar Boron – Medium (FBM), No Fungicide	426 c	351 c
Foliar Boron – High (FBH), No Fungicide	497 c	410 c
Grower Standard + FBL	937 ab	799 ab
Grower Standard + FBM	836 b	707 b
Grower Standard + FBH	914 ab	778 ab
Check - No Fungicide, No Boron	515 c	426 c
Pr > F	< 0.01	< 0.01

†Values followed by the same lowercase letter are not significantly different at (α=0.1).

‡Gross grower payment and net economic returns based upon harvest date adjustment factor for tonnage and RWST and trucking costs of $3.75/T.

Table 4. 2021 final disease index ratings.

Treatment	Disease Index† Sept. 9	Disease Index Sept. 27
Grower Standard Fungicide	17.3 b	41.5 c
Foliar Boron – Low (FBL), No Fungicide	89.0 a	73.8 a
Foliar Boron – Medium (FBM), No Fungicide	87.5 a	61.3 b
Foliar Boron – High (FBH), No Fungicide	88.8 a	71.3 ab
Grower Standard + FBL	21.3 b	30.0 cd
Grower Standard + FBM	20.3 b	31.3 cd
Grower Standard + FBH	12.5 b	28.0 d
Check - No Fungicide, No Boron	90.0 a	80.0 a
Pr > F	<0.01	<0.01

†Values followed by the same lowercase letter are not significantly different at (α=0.1).

‡ Disease index calculated from disease incidence and severity ratings recorded every 10-14 days post infection.

Table 5. Boron tissue concentration at 14-16 leaf stage.

Treatment	14-16 Leaf Tissue B Analysis (ppm)
Grower Standard Fungicide	33
Foliar Boron – Low (FBL), No Fungicide	33
Foliar Boron – Medium (FBM), No Fungicide	34
Foliar Boron – High (FBH), No Fungicide	34
Grower Standard + FBL	37
Grower Standard + FBM	33
Grower Standard + FBH	36
Check - No Fungicide, No Boron	35
Pr > F	NS

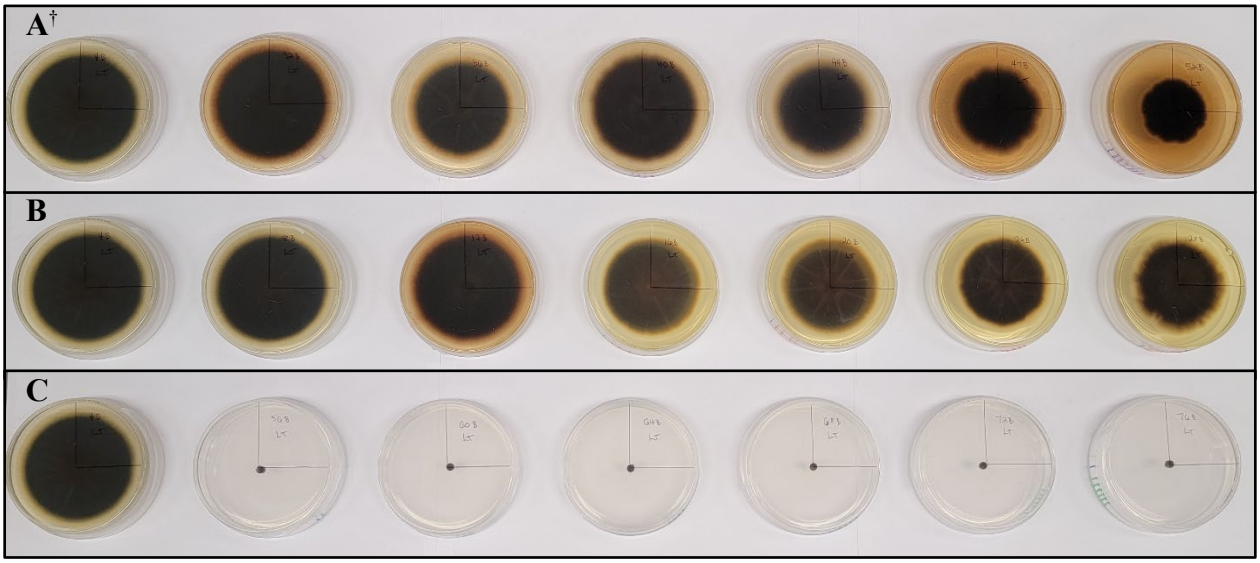
†Values followed by the same lowercase letter are not significantly different at (α=0.1).

Table 6. Estimated EC50 values of boron compounds across C. beticola isolates 'Range A' and 'Blum 1-2.'

Isolate	Compound	EC50† Estimate (ppm)
Blum 1-2	Boric Acid	>1,000
Blum 1-2	Sodium Tetraborate	761
Blum 1-2	Thiophanate-Methyl	< 1
Range A	Boric Acid	>1,000
Range A	Sodium Tetraborate	572
Range A	Thiophanate-Methyl	>1,000

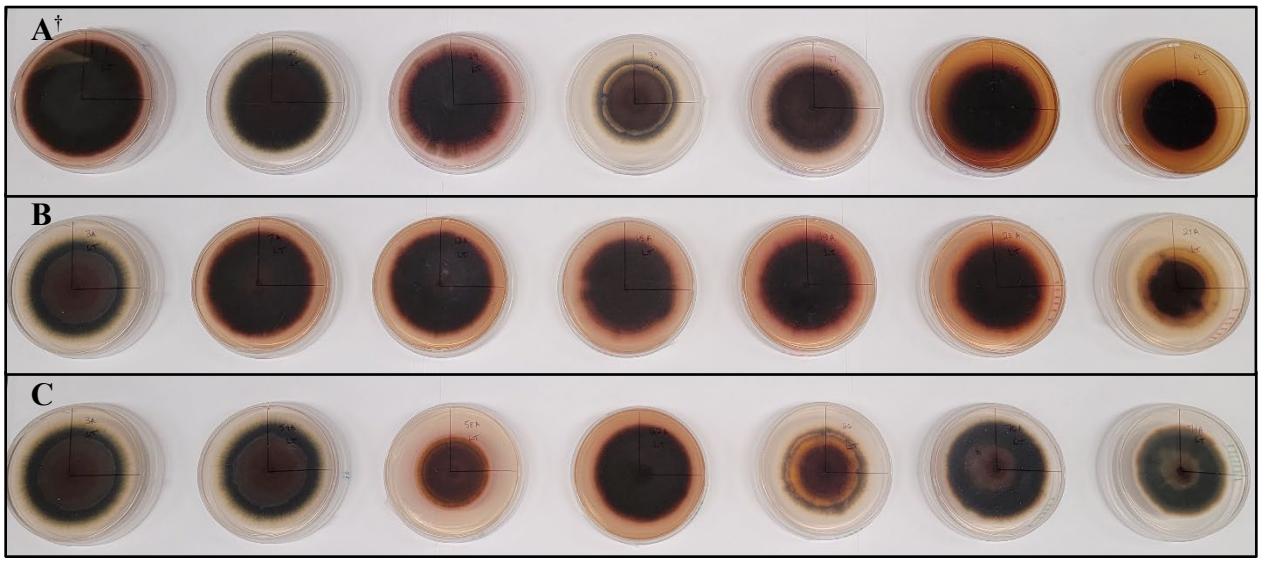
†Value of half maximal effective concentration i.e., 50% growth reduction as compared to control.

Figure 1. Day 21 radial growth of *C. beticola* isolate 'Blum 1-2.'



†Sodium tetraborate (1A), boric acid (1B), thiophanate-methyl (1C) concentrations displayed left to right (0, 1, 10, 50, 100, 300, 500 ppm).

Figure 2. Day 21 radial growth of *C. beticola* isolate 'Range A.'



†Sodium tetraborate (2A), boric acid (2B), thiophanate-methyl (2C) concentrations displayed left to right (0, 1, 10, 50, 100, 300, 500 ppm).

Summary: Trial quality was fair. Trial was established to evaluate the efficacy of foliar-applied boron for managing Cercospora leaf spot (CLS) in sugarbeet. Boron-containing compounds may have fungistatic properties as recent work has found reduced *in vitro* fungal growth and decreased disease severity in the field. All treatments received 90 lbs. N A^{-1} as pre-plant urea. Sidedress at 60 lbs N A^{-1} as UAN was applied at the 4-6 leaf stage on June 1. Warm April soil temperatures followed by a frost on April 20 resulted in stand loss and replant on May 7. Treatments initiated on June 28 and continued every 10-14 days through September 27. Applications were made using a CO_2 powered backpack sprayer equipped with four TJ 8002XR nozzles (30-in spacing), calibrated at 15 gal/A. Inoculation of *C. beticola* (100 spores/mL) was applied at 15 gal/A using a tractor mounted sprayer on July 12. Disease ratings were collected bi-weekly starting July 26 and continued until September 27. Plots were assigned a severity rating using the following scale based on infected leaf area: 1=0.1% (1-5 spots/leaf), 2=0.35% (6-12 spots/leaf), 3=0.75% (13-25 spots/leaf), 4=1.5% (26-50 spots/leaf), 5=2.5% (51-75 spots/leaf), 6=3%, 7=6%, 8=12% 9=25%, 10=50%. Disease incidence was recorded to represent the frequency of new lesion activity. First CLS observation was documented July 2.

Preliminary data indicate the grower standard fungicide program and grower standard fungicide + FBL boron maximized tonnage with the standard fungicide program driving differences in RWSA and RWST. *In vitro* analysis of boron-containing products demonstrated reduced relative growth with concentrations >100 ppm. Additional testing at field-representative rates will occur to validate current findings. Benzimidazole resistance was confirmed in *C. beticola* isolate 'Range A' (Figure 2C) via PCR-RFLP assay. *C. beticola* resistance to fungicides, sugarbeet varietal advancement, and production efficiency requirements encourages the search for alternative CLS management strategies.

MICHIGAN STATE UNIVERSITY EXTENSION

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Reexamining Boron Applications in Sugarbeet

Kurt Steinke and Andrew Chomas, Michigan State University
See soil.msu.edu for more information

Location: Saginaw Valley Research and Extension Center	**Tillage**: Conv., 30-in. row
Planting Date: April 19, 2021 (Harvest 10/20/21)	**Trt's**: See below
Soil Type: Clay loam; 2.5% OM; 7.8 pH; 29 ppm P; 133 ppm K	**Population**: 4 in. spacing
Variety: C-G675	**Replicated**: 4 replications

Treatment	RWSA	RWST	Tons/A	% Sugar	% CJP	Tissue B 12-14 leaf ppm
Check – No N, No Boron	10898	250	41	16.9	95.0	31
N Only, No Boron	11683	247	47	16.6	94.9	32
2 lb. B/A, 2x2 Applied	11427	247	46	16.7	94.8	37
1 lb B/A, 2-4 leaf 1 lb B/A 2 weeks after	10845	243	45	16.4	94.8	83
1 lb. B/A, 12-14 leaf 1 lb. B/A, 2 weeks after	12501	253	48	17.0	94.6	80
LSD $_{(0.10)}$[a]	**NS**	**NS**	**NS**	**NS**	**NS**	**10.2**

[a] LSD, least significant difference between means within a column at ($\alpha = 0.10$).

[b] NS, not significant

Summary: Trial quality was good. Trial was conducted to determine whether supplemental B applications may affect root yield and quality. Prior to the late 1990's, B application was recommended as varieties would often respond to B applications. Limited B accumulation in the soil, lack of incidental B in other bulk fertilizers, changes in the microenvironment, and increased disease occurrence may all interact affecting sugarbeet B response. Soil B concentrations were at or above 1 ppm in this study indicating sufficiency. All treatments other than the check received 40 lbs. N/A applied 2x2 with 120 lbs. N/A at 2-4 leaf coulter-inject sidedress. Boron applications consisted of 1) 2 lb. B/A applied 2x2, 2) l lb. B/A foliar applied at 2-4 leaf and 1 lb. B/A again 2 weeks later, and 3) l lb. B/A foliar applied at 12-14 leaf and 1 lb. B/A again 2 weeks later. Boron source consisted of Borosol 10 containing 1.1 lbs. B per gallon. Yield and 2021 sugar quality were not affected by B application in the current environment tested. Boron application increased tissue B concentration at 12-14 leaf indicating that B applied was taken up by the plant. However, yield and sugar quality were similar regardless of B application. Study will be repeated in 2022.

MICHIGAN STATE UNIVERSITY EXTENSION

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Sugarbeet Varietal Response to Fertilizer Strategy and Harvest Timing

Storm Soat and Kurt Steinke, Michigan State University

See soil.msu.edu for more information

Location: Saginaw Valley Research and Extension Center	**Tillage**: Conv., 30-in. row
Planting Date: April 19, 2021 (Harvest 8/25/21 & 10/20/21)	**Trt's**: See below
Soil Type: Clay loam; 2.5% OM; 7.8 pH; 29 ppm P; 133 ppm K	**Population**: 4 in. spacing
Variety: C-G675 & C-G919	**Replicated**: 4 replications

Table 1. Overview of fertilizer inputs applied.

Fertilizer Strategy (N-P-K)	Rate	Timing	Method
1) 28-0-0	60 lb. A	Planting	2x2†
2) 28-0-0 28-0-0	60 lb. A 100 lb. A	Planting 4 Leaf (June 1)	2x2 Side dress
3) 28-0-0 0-0-28	60 lb. A 100 lb. A	Planting 20 Leaf (June 22)	2x2 Banded next to row
4) 28-0-0 28-0-0 0-0-28	60 lb. A 100 lb. A 100 lb. A	Planting 4 Leaf (June 1) 20 Leaf (June 22)	2x2 Side dress Banded next to row

†Two inches below and two inches to the side of the seed.

Summary: Trial quality was good. Trial was conducted to determine whether a higher tonnage/higher sugar variety as compared to a more defensive, disease resistant variety respond differently to specific fertilizer management strategies and early vs. conventional harvest intervals. Altering management decisions such as variety, harvest timing, fertilizer strategy, or combinations of each may provide insight into producing the same or more sugar with less overall tons. The study was blocked by two harvest timings (early - 8/25/21 and conventional - 10/20/21) and two varieties (C-G675 and C-G919). All treatments received 60 lbs. N/A at planting applied 2x2. Fertilizer strategies consisted of only 60 lbs. N/A applied 2x2 at-plant, 60 lbs. N/A applied 2x2 and 100 lbs. N/A sidedress coulter inject at 4 leaf stage, 60 lbs. N/A applied 2x2 and 100 lbs. K_2O/A (0-0-28) surface applied next to row at canopy closure (~20 leaf stage), and 60 lbs. N/A applied 2x2 along with 100 lbs. N/A sidedress coulter inject at 4 leaf stage and 100 lbs. K_2O/A (0-0-28) surface applied next to row at canopy closure (~20 leaf stage). Nitrogen source was 28% UAN for both starter and sidedress N applications. Liquid potash (0-0-28) was used for mid-season K_2O applications. Soil test nutrient concentrations were all above critical

thresholds for this study. Canopy coverage was measured every two weeks until full canopy. Normalized Difference Vegetation Index (NDVI) and Fractional Green Canopy Cover via SPAD were measured at 6-8LF and 12-14LF.

In the first 35 days following planting, 0.74" of rain total in combination with cool temperatures restricted plant growth. Preliminary data show that although C-675 did produce more tonnage than C-919 at each harvest timing, there was no interaction between variety and harvest timing. October harvested beets yielded 16 tons per acre more than August harvest, but sugar concentrations decreased 0.37% with the October harvest due in part to the moist soil conditions encountered throughout autumn 2021. In the current study and environment tested, mid-season liquid K application did not affect yield or sugar quality. Regarding early harvest specifically, no tonnage differences were observed between starter N only as compared to starter N plus sidedress N indicating 2x2 starter N was sufficient for the early harvest interval in 2021. This study will be repeated in 2022.

Table 2. Sugarbeet 2021 yield, recoverable sugar per acre (RWSA), recoverable sugar per ton (RWST), sugar %, and clear juice purity (CLP).

Treatment	Tons	RWSA	RWST	% Sugar	% CJP
Variety					
C-G675	29.53 a *	†	259.8 a	17.01 a	94.73 a
C-G919	27.41 b		257.4 a	16.76 b	94.62 a
P > F	**0.06 ***		**NS**	**0.09**	**NS**
Harvest Timing					
Early	20.47 b	5499 b	269.4 a	17.07 a	94.59 b
Conventional	36.47 a	9021 a	247.8 b	16.70 b	94.76 a
P > F	**>0.001**		**>0.001**	**>0.01**	**0.09**
Fertilizer					
2x2 N only	25.01 b		259.8 a	16.83 a	94.69 a
2x2 + Sidedress N	32.39 a		256.5 a	16.88 a	94.60 a
2x2 + Liquid K	24.95 b		260.3 a	16.86 a	94.66 a
All	31.53 a		257.6 a	16.98 a	94.75 a
P > F	**>0.001**		**NS**	**NS**	**NS**
CHECK††	23.69	6200	256.5	16.82	94.67

*Values followed by the same lowercase letter are not significantly different at α = 0.10.
† See below for RWSA response to variety by fertilizer strategy interaction.
†† CHECK was not statistically analyzed with all other plot factors.

Table 3. Interaction between sugarbeet variety and fertilizer strategy on 2021 recoverable sugar per acre (RWSA).

Treatment	RWSA
C-G675	
2x2 N only	6153 d *
2x2 + Sidedress N	8715 a
2x2 + Liquid K	6549 cd
All	8923 a
C-G919	
2x2 N only	6660 bcd
2x2 + Sidedress N	7671 b
2x2 + Liquid K	6241 cd
All	7167 bc
P > F	**> 0.07**

*Values followed by the same lowercase letter are not significantly different at α = 0.10.

Table 4. No interaction occurred between sugarbeet variety and harvest timing on 2021 yield, recoverable sugar per acre (RWSA), recoverable sugar per ton (RWST), sugar %, and clear juice purity (CLP).

Treatment	Tons/A	RWSA	RWST	% Sugar	% CJP
Early Harvest					
C-G675	21.82 a *	5858 a	269.57 a	17.18 a	94.64 a
C-G919	19.12 a	5140 a	269.15 a	16.96 a	94.54 a
P > F	**NS ***	**NS**	**NS**	**NS**	**NS**
Conventional					
C-G675	37.24 a	9312 a	250.02 a	16.84 a	94.81 a
C-G919	35.70 a	8729 a	245.56 a	16.56 a	94.70 a
P > F	**NS**	**NS**	**NS**	**NS**	**NS**

*Values are not significantly different at α = 0.10.

Table 5. Main effects of sugarbeet variety and fertilizer strategy on 2021 % canopy coverage, NDVI measurements, and Percent Fractional Green Canopy Cover.

Treatment	% Canopy Coverage June 14	% Canopy Coverage June 29	% Canopy Coverage July 12	NDVI† June 14 (0-1)	% FGCC†† June 14
Variety					
C-G675	32 a *	67 b	79 b	0.89 a	44.2 a
C-G919	38 a	74 a	82 a	0.88 a	43.6 a
P > F	**NS**	**0.10**	**0.08**	**NS**	**NS**
Fertilizer					
2x2 N only	36 a	69 bc	77 b	0.89 a	43.7 a
2x2 + Sidedress N	34 a	72 ab	86 a	0.88 a	44.1 a
2x2 + Liquid K	34 a	65 c	73 c	0.88 a	43.4 a
All	35 a	75 a	86 a	0.89 a	444 a
P > F	**NS**	**>0.01**	**>0.001**	**NS**	**NS**

*Values followed by the same lowercase letter are not significantly different at α = 0.10.
† Normalized Difference Vegetation Index
†† Percent Fractional Green Canopy Cover

Table 6. Main effects of sugarbeet variety, harvest timing, and fertilizer strategy on 2021 gross grower payment and profitability analysis less trucking and or fertilizer cost.

Treatment	Gross Grower Payment ($/A)	Net Economic Return Less Trucking Costs ($/A) ††	Net Economic Return Less Fertilizer Costs and Trucking ($/A)
Variety			
C-G675	1835 a *	1724 a	1060 a
C-G919	1665 b	1563 b	898 b
P > F	**0.04**	**0.04**	**0.03**
Harvest Timing			
Early	1767 a	1690 a	1026 a
Conventional	1733 a	1597 a	932 a
P > F	**NS**	**NS**	**NS**
Fertilizer			
2x2 N only	1552 b	1458 b	1414 b
2x2 + Sidedress N	1982 a	1860 a	1737 a
2x2 + Liquid K	1527 b	1433 b	228 d
All	1940 a	1822 a	537 c
P > F	**>0.001**	**>0.001**	**>0.001**
CHECK†	1416	1327	1327

*Values followed by the same lowercase letter are not significantly different at α = 0.10.
†CHECK was not statistically analyzed with all other plot factors
††Trucking figured at $3.75/T

MICHIGAN STATE UNIVERSITY EXTENSION

Michigan State University AgBioResearch

Sugarbeet tolerance to postemergence applications of Ultra Blazer

Christy Sprague, Gary Powell and Brian Stiles II, Michigan State University

Location: Richville (SVREC)	**Application timings**: 2 lf beets (May 7), 6 lf beets (May 27), 10 lf beets (June 9)
Planting Date: April 6, 2021	**Herbicides:** see treatments
Soil Type: Clay loam	**O.M.:** 2.6 **pH:** 7.9
Replicated: 4 times	**Variety:** Crystal G675RR

Table 1. Sugarbeet tolerance to POST applications of Ultra Blazer (aciflurofen) applied at various sugarbeet stages and with various mixtures, 7 d after the 6- and 10-lf application and in late-August.

Herbicide treatments[a]	Timing	Injury (June 3)	Injury (June 16)	Injury (August 24)	Yield	RWSA
		—%—	—%—	—%—	– ton/A –	– lb/A –
Roundup PowerMax (32/22/22 fl oz)	2-, 6-, 10 lf	2	0	0	35.8	8109
Ultra Blazer (8/8 fl oz)	6-, 10 lf	29*[b]	28*	0	28.7*	6535*
Ultra Blazer (16/16 fl oz)	6-, 10 lf	30*	30*	0	26.9*	6156*
Ultra Blazer (16 fl oz)	6 lf	30*	12*	0	33.1	7372
Ultra Blazer (16 fl oz)	10 lf	4	23*	0	30.8	7007
Ultra Blazer (16 fl oz) + Moccasin II Plus (1.33 pt)	6 lf	69*	19*	0	28.3*	6381*
Ultra Blazer (16 fl oz) + Warrant (3 pt)	6 lf	24*	6	0	36.3	8003
Ultra Blazer (16 fl oz) + Outlook (16 fl oz)	6 lf	36*	10*	0	33.3	7688
Ultra Blazer (16 fl oz) + Ethofumesate (32 pt)	6 lf	28*	8*	0	33.7	7833
Stinger (2 fl oz) fb. Ultra Blazer (16 fl oz) + Stinger (4 fl oz)	2-, 6 lf	29*	9*	0	31.1	7365
Stinger (2 fl oz) fb. Stinger (4 fl oz)	2-, 6 lf	4	6	0	30.7	7105
$LSD_{0.05}$[c]		*7*	*7*	*0*	*5.9*	*1432*

[a] Roundup PowerMax was included in all postemergence treatments at the rates listed in the first treatment. These treatments also included AMS at 17 lb/100 gal.

[b] Injury, yield and RWSA data with asterisks (*) are significantly different than the Roundup PowerMax alone control.

[c] Means within a column greater than least significant difference (LSD) value are different from each other.

Summary: Options are extremely limited for POST control of glyphosate-resistant waterhemp in sugarbeet. Ultra Blazer (aciflurofen) is a Group 14 herbicide that has activity on pigweed species. Over the past four years we have conducted field research evaluating sugarbeet safety to POST applications of Ultra Blazer. Ultra Blazer injury to sugarbeet consists of leaf speckling/bronzing. The greatest injury from Ultra Blazer was when Ultra Blazer was tank-mixed with Moccasin II Plus (similar to Dual II Magnum). This treatment along with two applications of Ultra Blazer at 8 or 16 fl oz/A resulted in significant yield and RWSA reductions. Other tank-mixtures with/or Ultra Blazer alone at the 6- or 10-lf stage also resulted in injury, however sugarbeet was able to recover and sugarbeet yield and recoverable white sugar were not affected. This research helps support Michigan's 2021 Section 18 registration that allowed for Ultra Blazer applications on sugarbeets >6-leaf at a 16 fl oz/A rate.

MICHIGAN STATE UNIVERSITY EXTENSION

Michigan State University AgBioResearch

Sugarbeet tolerance to overlapping residual herbicide programs

Christy Sprague, Gary Powell and Brian Stiles II, Michigan State University

Location: Richville (SVREC)	**Application timings**: PRE (April 7), 2-lf beets (May 7), 6-8 lf beets (May 27)
Planting Date: April 6, 2021	**Herbicides:** see treatments
Soil Type: Clay loam	**O.M.:** 2.6 **pH:** 7.9
Replicated: 4 times	**Variety:** Crystal G675RR

Table 1. Comparison of sugarbeet tolerance and common lambsquarters control (CHEAL) of overlapping residual herbicide programs applied POST alone and with a low rate (0.5 pt/A) of Dual Magnum (PRE).

Herbicide treatments[a]		Injury (7 DA-6lf)	CHEAL control (90 DA-6lf)	Yield	RWSA
PREs	***POST at 2- and 6-lf beets***	—%—	—%—	-ton/A-	—lb/A—
None	Roundup PowerMax (32/22 fl oz)	5	83	34.8	8307
None	Dual Magnum (1.3/1.3 pt)	6	90	31.4	7453
None	Warrant (3/3 pt)	6	57*	28.7*	6867*
None	Outlook (12/12 fl oz)	14*[b]	96	36.0	8592
Dual Magnum	Dual Magnum (1.33 pt) – 2 lf only	2	84	36.6	8222
Dual Magnum	Warrant (3 pt) – 2 lf only	1	79	34.3	8428
Dual Magnum	Outlook (16 fl oz) – 2 lf only	0	86	36.9	8812
Dual Magnum	Dual Magnum (1.3/1.3 pt)	7	99	34.8	7914
Dual Magnum	Warrant (3/3 pt)	3	47*	24.4*	5649*
Dual Magnum	Outlook (12/12 fl oz)	5	93	32.4	7745
Dual Magnum	Warrant (3 pt)/ Dual Magnum (1.3 pt)	7	93	32.5	7821
Dual Magnum	Outlook (16 fl oz)/ Dual Magnum (1.3 pt)	7	95	34.0	8147
Dual Magnum	Stinger (2/4 fl oz)	10*	82	33.9	8119
Dual Magnum	Stinger (2 fl oz) + Warrant (3 pt) Stinger (4 fl oz) + Dual Mag. (1.3 pt)	8	85	33.3	7751
$LSD_{0.05}$[c]		*5[c]*	*9*	*5.9*	*1394*

[a] Dual Magnum was applied PRE at 0.5 pt/A. Roundup PowerMax was applied at the 2- and 6-leaf stages at the rates listed in the first treatment. All treatments included AMS at 17 lb/100 gal.

[b] Data with asterisks (*) indicate significantly higher injury, and lower CHEAL control, yield and RWSA than the Roundup PowerMax alone control.

[c] Means within a column greater than least significant difference (LSD) value are different from each other.

Summary: Overlapping residual herbicide programs may be the only way to effectively control glyphosate-resistant pigweed (waterhemp and Palmer) in sugarbeet. The Group 15 herbicides, Dual II Magnum, Outlook and Warrant were all evaluated at various rates and timings to determine sugarbeet tolerance and common lambsquarters control, including PRE applications of a low rate of Dual Magnum (24C label). In general, sugarbeet injury was less than 15%. This year the combination of Warrant + Roundup PowerMax resulted in reduced common lambsquarters control, this resulted in a significant reduction in yield and RWSA from common lambsquarters competition. This antagonistic response is not common and could be due to colder air temperatures <60ºF at the time of application. This response needs to be examined further. Several of these treatments were also examined for waterhemp control and should continue to be examined over more environments.

MICHIGAN STATE UNIVERSITY EXTENSION

Michigan State University AgBioResearch

Sugarbeet safety to high load Warrant applications

Christy Sprague, Gary Powell and Brian Stiles II, Michigan State University

Location: Richville (SVREC)	**Application timings**: 4 lf beets (May 19)
Planting Date: April 6, 2021	**Herbicides:** see treatments
Soil Type: Clay loam	**O.M.:** **2.6** **pH:** 7.9
Replicated: 4 times	**Variety:** Crystal G675RR

Table 1. Evaluation of a new high load formulation of Warrant (MON 301668) on sugarbeet tolerance and common lambsquarters control.

	7 DAT		14 DAT		28 DAT	
Treatments[a]	**Injury**	**Control**	**Injury**	**Control**	**Injury**	**Control**
Warrant (48 fl oz)	8	74	6	73	2	59
Warrant (64 fl oz)	15	71	14	70	5	55
MON 301668 (30 fl oz)	7	77	7	68	2	55
MON 301668 (42 fl oz)	16	72	12	69	5	33
Roundup PowerMax 3 (30 fl oz)	2	100	0	100	3	97
MON 301668 (42 fl oz) + Roundup PowerMax 3 (30 fl oz)	15	98	14	100	6	96
Stinger (8 fl oz) + MON 301668 (42 fl oz) + Roundup PowerMax 3 (30 fl oz)	34	100	24	100	9	100
Ethofumesate (12 fl oz) + MON 301668 (42 fl oz) + Roundup PowerMax 3 (30 fl oz)	12	99	7	100	4	100
SelectMax (9 fl oz) + MON 301668 (42 fl oz) + Roundup PowerMax 3 (30 fl oz)	15	98	13	100	6	97
Dual Magnum (1.33 pt) + Roundup PowerMax 3 (30 fl oz)	6	96	3	100	4	100
Outlook (16 fl oz) + Roundup PowerMax 3 (30 fl oz)	0	99	1	100	3	100
$LSD_{0.05}$[b]	*4.8*	*7.5*	*5.5*	*8.9*	*3.8*	*13.1*

[a] Roundup PowerMax 3 at 30 fl oz/A + AMS at 17 lb/100 gal was applied to the entire plot area at 2-leaf sugarbeet.
[b] Means within a column with different letters are significantly different from each other.

Summary: Warrant (acetochlor) is a Group 15 herbicide that is commonly applied with glyphosate as a layby residual product in sugarbeet, once sugarbeet has reached the 2-leaf stage or greater. A new high load formulation of Warrant (MON 301668) was examined for crop tolerance and weed control. The high load formulation is a 4.61 L versus the current formulation of Warrant 3 L, resulting in lower product rates. Sugarbeet tolerance was similar between the high load and current formulation of Warrant. Warrant does not have foliar activity, so control is only in the form of residual activity. Therefore, it is important to apply it with herbicide that will control the emerged weeds. The addition of the high load formulation did not reduce herbicide activity on c. lambsquarters with any of the tank-mix partners. Sugarbeet injury that was observed was similar to the high load formulation alone with the exception of the Stinger tank-mixture, where injury was consistent with the high rate of Stinger.