

**UNIVERSITY OF
DELAWARE**



LIMA BEAN

VARIETY

TRIAL

RESULTS

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2021

2021 UNIVERSITY OF DELAWARE GREEN BABY LIMA BEAN VARIETY TRIALS

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In 2021 two trials of baby lima varieties were planted at the University of Delaware Research Farm in Georgetown, Delaware: an irrigated trial of commercial varieties and advanced breeding lines, and an irrigated trial of newly developed breeding lines.

Irrigated Advanced Baby Lima Bean Variety Trial at Georgetown, DE

Planted June 8, 2021

The Irrigated Baby Lima Bean Variety Trial was planted on June 8 and included a total of 61 lines. Five of the lines were entered by ADM Seedwest. Fifty-two lines were from the University of Delaware lima bean breeding program. The remaining four lines were standard varieties planted as checks. The purpose of this trial is to evaluate new processing green baby lima bean varieties for yield, maturity, and quality under Delaware growing conditions.

Entries in the Irrigated Baby Lima Bean Variety Trial Planted June 9, 2021

Variety Name	Source	Variety Name	Source	Variety Name	Source
DE0802101A	UD	DE1500302B	UD	DE1603602B	UD
DE1001202C	UD	DE1500303C	UD	DE1603602C	UD
DE1001202E	UD	DE1500405A I	UD	DE1603608	UD
DE1001802A	UD	DE1500405A II	UD	DE1603609	UD
DE1201101A	UD	DE1500406C	UD	DE1604111	UD
DE1202203A	UD	DE1500703B I	UD	DE1604113	UD
DE1304306	UD	DE1600302f	UD	Emperor	ADM
DE1304601f	UD	DE1600303f	UD	G6017125	ADM
DE1304603f	UD	DE1600901f	UD	G3019326	ADM
DE1304605f	UD	DE1600902f	UD	G6019146	ADM
DE1304614f	UD	DE1603402A	UD	G6019134	ADM
DE1304624f	UD	DE1603502C	UD		
DE1305306	UD	DE1603502D	UD		
DE1305401	UD	DE1603507E	UD		
DE1306001A	UD	DE1603508E I	UD		
DE1306002C	UD	DE1603508E II	UD		
DE1306003A	UD	DE1603508I	UD		
DE1306583	UD	DE1603509B	UD		
DE1306635	UD	DE1603512C	UD		
DE1306927	UD	DE1603513B	UD		
DE1500806J f	UD	DE1603514C	UD		
DE1500301A	UD	DE1603515C	UD		
DE1500301C	UD	DE1603602A	UD		

Standard Varieties

Cypress	ADM
C-elite Select	Dompe
184-85	Dompe
Meadow	ADM

Location:

Field 2 at the University of Delaware Research and Education Center Farm, Georgetown, DE

Cultural Practices:

The trial was planted on June 8, 2021 with a Kinze cone planter. Seed of standard varieties and ADM entries was treated with fungicide, UD entries were not. Varieties were planted in one-row plots with 30 inch between row spacing and 3 inch in-row spacing. Plots were 20 feet in length. The variety 'Cypress' was planted as a border next to outside rows. Plots were arranged in a randomized complete block design with four replications. The field was fertilized with potassium before planting according to soil test results. An application of 1.25 pt/A Dual Magnum 17 gpa N SUL 33 (27-0-0-6S) (50 lbs/a of N) was made pre-emergence. Plots were sidedressed with 10 gpa N-SUL 33 (30 lb/A of N) on July 6. One cultivation and additional hand weeding were done to control weeds. Weed control in the trial was good. Mustang Max at 4 oz/A was applied on July 20 to control stinkbug and lygus.

Harvest:

Harvest decisions were made based on visual evaluation of the individual plot. Plots were harvested to maximize the number of full (as opposed to dry or flat) pods. Not all replications for a variety were harvested on the same day. Harvest began on August 25 (78 DAP) and ended on September 4 (88 DAP).

A 10-foot section from each plot was harvested. The plants were cut off at soil level and weighed. The plants were fed into a stationary FMC viner. Trash was removed from the shelled beans with a fan and a screen, and the cleaned beans were weighed to determine yield.

**Irrigated First Year Trial of Baby Lima Breeding Lines at Georgetown, DE –
Planted June 24, 2021**

The Irrigated First Year Trial of Baby Lima Bean Breeding Lines was planted on June 24 and included a total of 38 lines in replicated plots and 27 lines in single plots. Sixty-two of the entries were breeding lines were from the University of Delaware lima bean breeding program that were being evaluated for yield and days to harvest for the first time. The other three lines were standard commercial cultivars. The purpose of this trial is to evaluate new UD breeding lines for yield, maturity, and quality under Delaware growing conditions.

Entries in the Irrigated 1st Year Trial of Baby Lima Breeding Lines, Planted June 24, 2021

Variety Name	Source	Variety Name	Source	Variety Name	Source
DE1600102C	UD	DE1602502D	UD	DE16040373A	UD
DE1600102D	UD	DE1602504E	UD	DE16040388A	UD
DE1600103A	UD	DE1602505B	UD	DE16040388B	UD
DE1600103D	UD	DE1602901A	UD	DE16040402A	UD
DE1600202A	UD	DE1602902A	UD	DE16040402B	UD
DE1600202C	UD	DE1602907A	UD	DE16040410B	UD
DE1600202D	UD	DE1602908A	UD	DE16040440B	UD
DE1600204A	UD	DE1603001A	UD	DE16042475A	UD
DE1600204B	UD	DE1603001C	UD	DE16042475B	UD
DE1600204C	UD	DE1603003C	UD	DE16042513S	UD
DE1600801C	UD	DE1603005A	UD	DE16042582B	UD
DE1600804C	UD	DE17215A	UD	DE16042592A	UD
DE1601001A I	UD			DE1712103616A	UD
DE1601001A II	UD	<i>Single Plots</i>		DE1712107648A	UD
DE1601002B	UD	DE16037210B	UD	DE1712114711B	UD
DE1601003C	UD	DE16037234B	UD	DE1712127928A	UD
DE1602201A	UD	DE16038254A	UD	DE1712127932B	UD
DE1602202C	UD	DE16038271B	UD	DE1712129948A	UD
DE1602203A I	UD	DE16038274B	UD		
DE1602203A II	UD	DE16039301A	UD	<i>Standard Varieties</i>	
DE1602204A	UD	DE16039304A	UD	Emperor	ADM
DE1602304B	UD	DE16039334B	UD	Cypress	ADM
DE1602501F	UD	DE16039337A	UD	C-elite Select	Dompe

Location:

Field 2 at the University of Delaware Research and Education Center Farm, Georgetown, DE

Cultural Practices:

The trial was planted on June 24, 2021. Seed of standard varieties was treated with fungicide, UD entries were not. Replicated varieties were planted with a Kinze cone planter in one-row plots that were 20 ft long with 30 inch between row spacing and 3 inch in-row spacing. Plots

were arranged in a randomized complete block design with three replications. Single plots were 10 feet in length and planted by hand. The variety ‘Cypress’ was as a border for the outside rows. The field was fertilized with potassium before planting according to soil test results. An application of 1.25 pt/A Dual Magnum 17 gpa N SUL 33 (27-0-0-6S) (50 lbs/a of N) was made pre-emergence. Plots were sidedressed with 10 gpa N-SUL 33 (30 lb/A of N) on August 25. One cultivation and additional hand weeding were done to control weeds. Weed control in the trial was good. Mustang Max at 4 oz/A was applied on July 20 to control stinkbug and lygus.

Harvest:

Harvest decisions were made based on visual evaluation of the individual plot. Plots were harvested to maximize the number of full (as opposed to dry or flat) pods. Not all replications for a variety were harvested on the same day. Harvest began on September 6 (74 DAP) and ended on September 14 (82 DAP).

A 10-foot section from each plot was harvested. The plants were cut off at soil level and weighed. The plants were fed into a stationary FMC viner. Trash was removed from the shelled beans with a fan and a screen, and the cleaned beans were weighed to determine yield.

Results and Discussion of the Baby Lima Trials at Georgetown

Weather, Pod Set and Maturity for the Baby Lima Trials

In the Advanced Trial, planted June 8, days to harvest for Cypress, C-elite Select and 184-85 were slightly shorter than recent averages (since 2010). Based on past year’s trials, night temperatures in the early flowering period are most strongly correlated to delayed maturity because of heat stress. This occurs in the 600-700 accumulated base 10 °C GDD for early varieties and 700-800 base 10 °C GDD for longer season varieties. Night temperatures averaged 66.2 F in the 600-700 GDD interval (42-48 DAP) and 67.1 F in the 700-800 GDD interval (49-55 DAP). In both intervals two of seven nights were above 70 °F. The Advanced Trial was exposed to moderate, but not excessive heat stress.

Days to Harvest in Irrigated Baby Lima Trials

Year	Planting Date	Cypress	C-elite Select	184-85
2006-09 Avg	11-Jun	77	84	86
2010	6-Jun	91	96	95
2011	6-Jun	97	98	99
2012	14-Jun	82	89	88
2013	13-Jun	77	89	89
2014	13-Jun	82	91	86
2015	9-Jun	79	86	87
2016	9-Jun	89	98	96
2017	9-Jun	86	91	--
2018	29-Jun	70	82	82
2019	5-Jun	88	91	91
2020	9-Jun	70	87	90
2021	8-Jun	79	88	88

The 1st Year Trial was planted June 24. For this trial, night temperatures averaged 64.0 F in the 600-700 GDD interval (40-47 DAP) with one of eight nights above 70 °F. Night temperatures averaged 71.2 F in the 700-800 GDD interval (48-53 DAP) with four of six nights above 70 °F. Varieties in this trial matured quickly probably because of very favorable conditions for pod set in the 600-700 GDD interval. Wet conditions in the from 44 DAP onward caused pod rot from *Phytophthora capsici* to develop in this trial.

Yield and Maturity in the June 85th Planted Advanced Baby Lima Trial

The purpose of the Advanced Baby Lima Trial is to evaluate previously tested breeding material from the University of Delaware, as well as varieties available from commercial suppliers under irrigated conditions. There were significant differences in yield between the varieties in this trial (Table 1). Yields were good to average in this trial. The highest yielding entry in the 2021 trial was DE1305306. It was the only variety to produce significantly higher yields than all five standard varieties (Cypress, C-elite Select, 184-85, Emperor and Meadow). There were 14 lines that did not have significantly different yields than DE1305306: DE0802101A, DE1202203A, DE1306003A, DE1201101A, DE1603602B, DE1304603f, DE1306001A, DE1001202C, DE1306002C, DE1001802A, DE1500806J f, DE1500301C, DE1500405A I and DE1001202E. Several lines were harvested before Meadow and Cypress, the earliest standard variety, but none were significantly shorter in days to harvest (Figure 1)

This trial included eleven breeding lines with resistance to root knot nematode (as determined in a separate, inoculated field screen) and 25 lines with upright architecture.

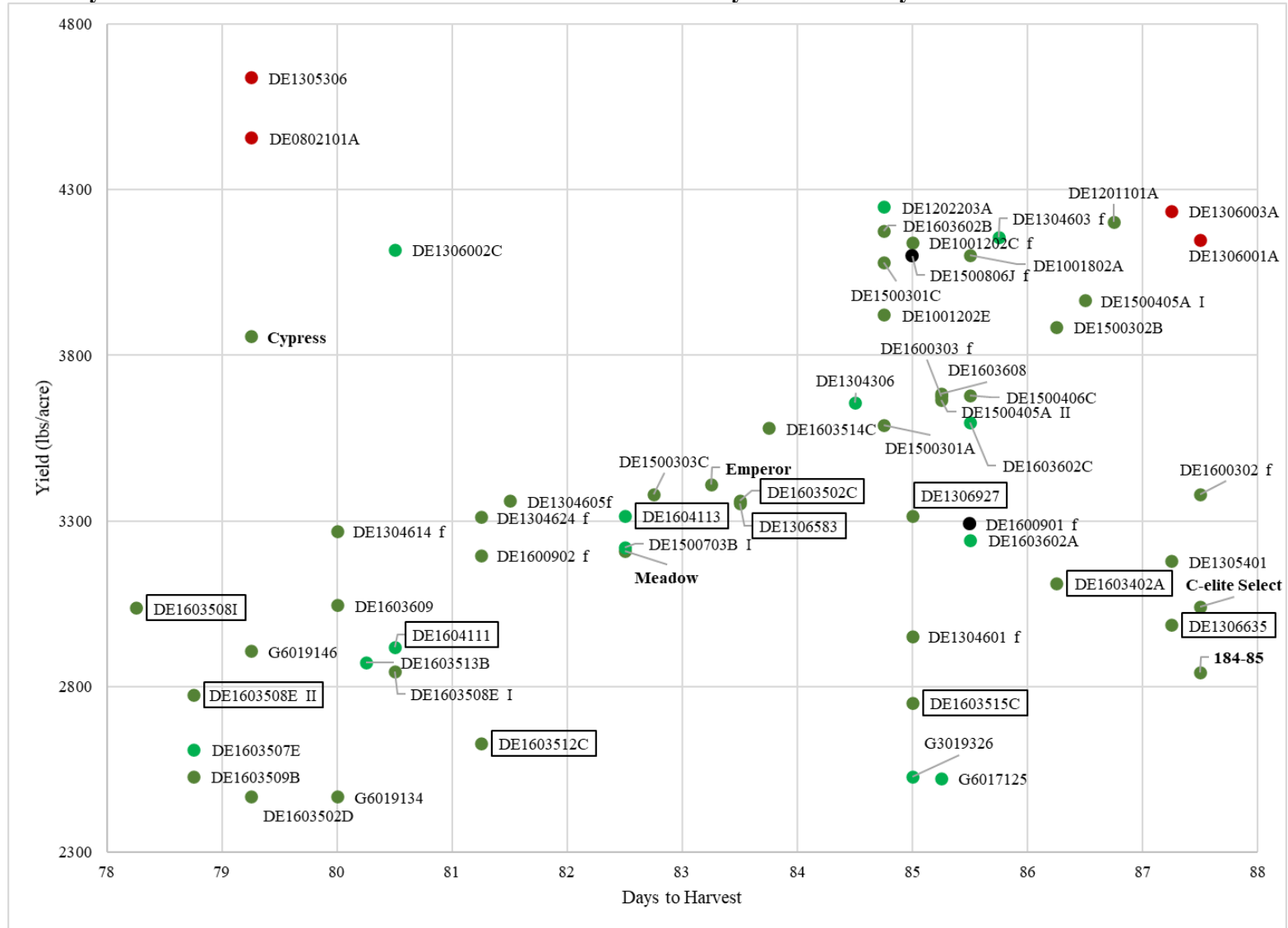
Trial of First Year Breeding Lines Planted June 24

Breeding lines that were being evaluated for the first time were tested in a separate trial. The results from this trial are in Table 2 and Figure 2. Yields of the three standard varieties in this trial (Cypress, C-elite Select, Emperor) were lower than in the Irrigated Advanced Trial, possibly because all three developed lima bean pod rot caused by *P. capsici*. Many of the lines in this trial were selected for heat stress tolerance. Thirteen of the lines in this trial were selected for evaluation in the Advanced Trial in 2022: DE1600204A, DE1602902A, DE1602908A, DE1600801C, DE1602203A I, DE1600103D, DE1602505B, DE1602501F, DE1602504E, DE1600202A, DE1600202D, DE17215A and DE1601003C.

Breeding Lines Evaluated in Single Plots Planted June 24

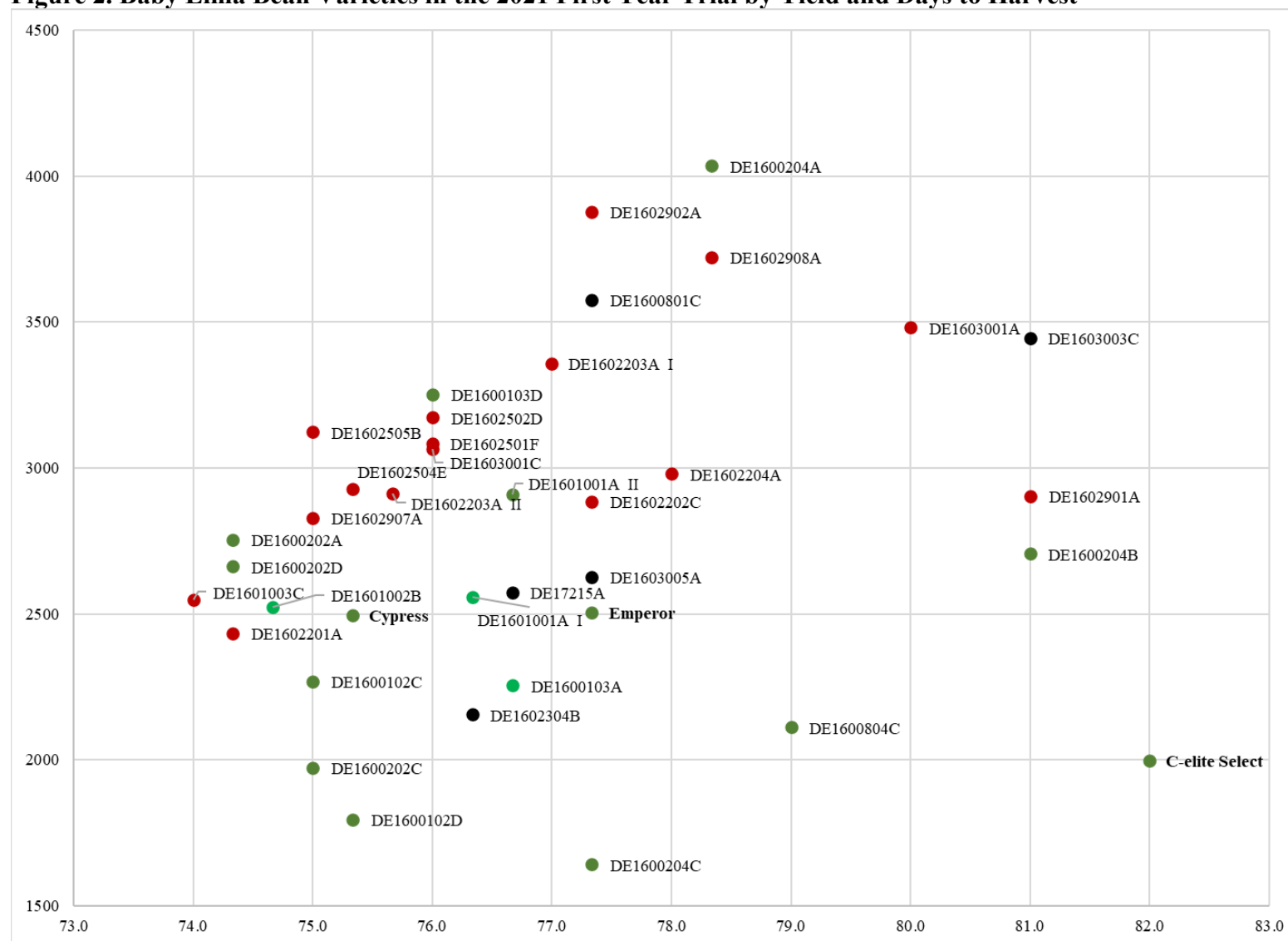
Twenty-seven lines were evaluated for yield in single plots with results in Table 3 and Figure 3. These lines were had been screened for heat tolerance, race F downy mildew resistance and root-knot nematode resistance during the breeding process. Seventeen of these lines will be evaluated in a replicated trial in 2022.

Figure 1. Baby Lima Bean Varieties in the 2021 Advanced Line Trial by Yield and Days to Harvest*



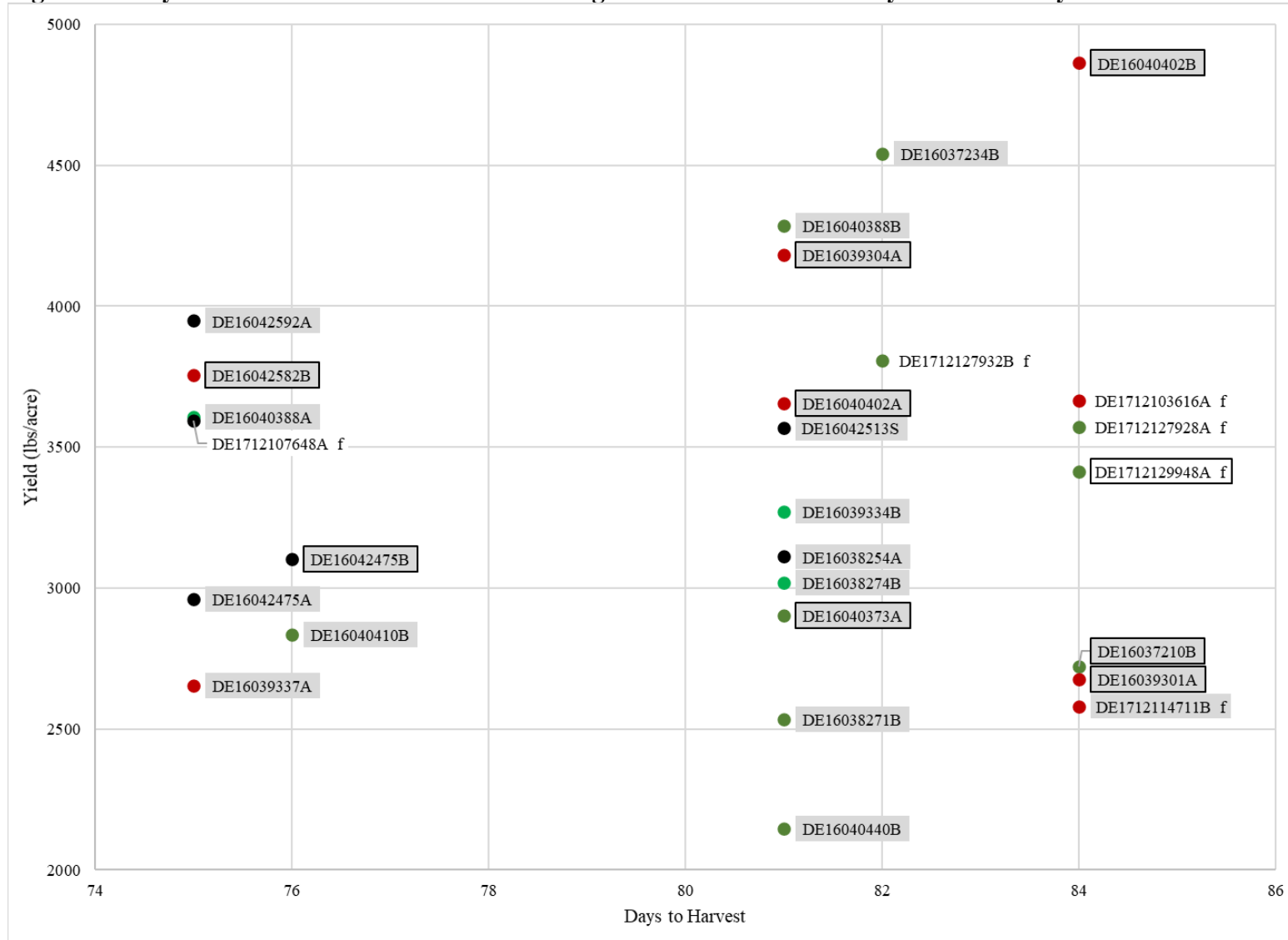
* Color of data label indicates seed color: **Green**, **Light Green**, **White/Green**, **Pink**, **Red** or **Purple**. “f” at end of name =resistant to race F of downy mildew. Black label border indicates Root-knot nematode resistance.

Figure 2. Baby Lima Bean Varieties in the 2021 First Year Trial by Yield and Days to Harvest*



* Color of data label indicates seed color: **Green**, **Light Green**, **White/Green**, **Pink**, **Red or Purple**.

Figure 3. Baby Lima Bean Varieties in the 2021 Single Plot First Year Trial by Yield and Days to Harvest*



* Color of data label indicates seed color: **Green, Light Green, White/Green, Pink, Red or Purple**. “f” at end of name =resistant to race F of downy mildew. Black label border indicates Root-knot nematode resistance. Highlighted label indicates heat tolerant in greenhouse screen.

Table 1. Days to Harvest, % Stand, Yield, % Conversion, Seed Color and Other Traits for the Irrigated Advanced Baby Lima Variety Trial Planted June 8, 2021

Variety	DTH	% Stand	Yield (lbs/acre)	% Conversion ¹	Seed Color	Other Traits
DE1305306	79.3 m-o	74.8 a-l	4639 a	19.1 a-f	pink/red speckle	A+
DE0802101A	79.3 m-o	72.5 a-m	4457 ab	19.6 abc	buff/black speckle	
DE1202203A	84.8 e-i	78.5 a-g	4248 abc	18.6 a-g	lt green	A+
DE1306003A	87.3 ab	80.3 a-e	4236 abc	16.7 g-m	red	
DE1201101A	86.8 a-c	76.0 a-k	4204 abc	16.6 g-n	green	A+
DE1603602B	84.8 e-i	81.8 a-d	4175 abc	16.4 g-n	green	
DE1304603f	85.8 b-f	77.0 a-j	4157 abc	16.6 g-n	lt green	A
DE1306001A	87.5 a	72.3 a-m	4149 abc	15.3 j-p	red/dk red speckle	
DE1001202C	85.0 d-h	60.8 h-n	4141 a-d	17.8 b-i	green	A++
DE1306002C	80.5 lm	78.0 a-h	4119 a-d	16.7 g-m	lt green	A+
DE1001802A	85.5 c-f	70.3 a-n	4102 a-e	17.2 e-k	green	
DE1500806J f	85.0 d-h	79.0 a-f	4100 a-e	15.9 h-o	wt green	A+
DE1500301C	84.8 e-i	62.3 f-n	4081 a-f	19.6 abc	green	A++
DE1500405A I	86.5 a-d	60.8 h-n	3966 a-g	17.1 e-k	green	A+
DE1001202E	84.8 e-i	76.8 a-j	3922 a-h	17.7 b-i	green	A++
DE1500302B	86.3 a-e	61.0 g-n	3885 b-i	17.0 f-l	green	A++
Cypress	79.3 m-o	86.0 ab	3857 b-i	16.1 h-n	green	
DE1603608	85.3 c-g	77.8 a-i	3684 c-j	15.7 i-p	green	
DE1500406C	85.5 c-f	64.0 e-n	3680 c-j	14.7 l-r	green	A
DE1600303f	85.3 c-g	62.8 e-n	3677 c-j	16.1 h-n	green	A+
DE1500405A II	85.3 c-g	79.0 a-f	3665 c-j	16.6 g-n	green	A+
DE1304306	84.5 f-i	74.8 a-l	3658 c-j	19.3 a-e	lt green	A
DE1603602C	85.5 c-f	65.8 c-n	3599 c-k	17.6 b-j	lt green	
DE1500301A	84.8 e-i	86.0 ab	3590 c-k	15.3 j-p	green	A+
DE1603514C	83.8 g-j	59.5 j-n	3580 c-l	19.9 ab	green	A+
Emperor	83.3 ij	62.8 e-n	3410 d-m	18.2 b-h	green	
DE1500303C	82.8 jk	82.5 a-c	3381 e-m	14.7 l-s	green	A
DE1600302f	87.5 a	75.8 a-k	3379 e-m	11.9 t	green	A+
DE1603502C	83.5 h-j	69.0 b-n	3362 f-n	19.3 a-f	green	
DE1304605f	81.5 kl	63.5 e-n	3360 f-n	17.1 e-k	green	
DE1306583	83.5 h-j	60.3 i-n	3354 f-n	17.6 b-j	green	RKN
DE1306927	85.0 d-h	64.8 d-n	3316 g-o	16.5 g-n	green	RKN
DE1604113	82.5 jk	74.8 a-l	3315 g-o	19.6 a-d	lt green	A
DE1304624f	81.3 kl	76.3 a-k	3312 g-o	14.7 l-s	green	
<i>p-value</i>	<i><0.0001</i>	<i><0.0001</i>	<i><0.0001</i>	<i><0.0001</i>		
<i>LSD</i> ²	<i>1.6926</i>	<i>17.6</i>	<i>736.99</i>	<i>2.34</i>		
<i>CV</i> ³	<i>1.5</i>	<i>19.1</i>	<i>15.5</i>	<i>10.4</i>		

¹% Conversion is yield of succulent beans divided by total plant biomass. ²Means followed by the same letter are not significantly different according to Fisher's LSD. ³Coefficient of Variation.

Table 1 continues on the next page.

Table 1 Continued. Days to Harvest, % Stand, Yield, % Conversion, Seed Color and Other Traits for the Irrigated Advanced Baby Lima Variety Trial Planted June 8, 2021

Variety	DTH	% Stand	Yield (lbs/acre)	% Conversion ¹	Seed Color	Other Traits
DE1600901f	85.5 c-f	69.0 b-n	3293 g-o	14.5 m-s	wt green	A+
DE1304614f	80.0 l-n	71.5 a-n	3269 g-o	14.3 n-s	green	
DE1603602A	85.5 c-f	61.0 g-n	3243 g-p	16.8 g-m	lt green	
DE1500703B I	82.5 jk	59.0 k-n	3219 h-p	15.8 i-o	lt green	
Meadow	82.5 jk	72.5 a-m	3210 h-p	16.3 g-n	green	
DE1600902f	81.3 kl	62.3 f-n	3196 h-q	14.6 m-s	green	A
DE1305401	87.3 ab	72.8 a-m	3179 i-q	13.4 p-t	green	A
DE1603402A	86.3 a-e	62.8 e-n	3113 j-q	15.1 k-q	green	
DE1603609	80.0 l-n	69.0 b-n	3046 j-q	13.7 o-t	green	
C-elite Select	87.5 a	87.0 a	3042 j-q	11.5 t	green	
DE1603508I	78.3 o	65.8 c-n	3038 j-q	17.3 c-k	green	
DE1306635	87.3 ab	66.0 c-n	2986 j-q	12.4 st	green	RKN
DE1304601f	85.0 d-h	82.0 a-d	2952 j-q	12.7 rst	green	
DE1604111	80.5 lm	71.0 a-n	2919 k-q	15.5 i-p	lt green	
G6019146	79.3 m-o	57.8 l-n	2907 k-q	15.9 h-o	green	
DE1603513B	80.3 l-n	73.5 a-l	2873 k-q	13.7 o-t	lt green	A+
DE1603508E I	80.5 lm	63.8 e-n	2847 l-q	15.7 i-p	green	
184-85	87.5 a	77.8 a-i	2845 l-q	11.4 t	green	
DE1603508E II	78.8 no	72.8 a-m	2776 m-q	14.5 m-s	green	
DE1603515C	85.0 d-h	57.3 l-n	2750 m-q	17.2 d-k	green	
DE1603512C	81.3 kl	74.8 a-l	2630 n-q	14.7 l-s	green	
DE1603507E	78.8 no	54.5 n	2609 opq	15.5 i-p	lt green	
G3019326	85.0 d-h	35.3 o	2530 pq	20.6 a	lt green	
DE1603509B	78.8 no	55.8 mn	2529 pq	15.1 k-q	green	
G6017125	85.3 c-g	69.5 a-n	2523 pq	16.4 g-n	lt green	
DE1603502D	79.3 m-o	67.8 c-n	2469 q	12.9 q-t	green	
G6019134	80.0 l-n	61.5 f-n	2468 q	13.7 o-t	green	
<i>p-value</i>	<i><0.0001</i>	<i><0.0001</i>	<i><0.0001</i>	<i><0.0001</i>		
<i>LSD</i> ²	<i>1.6926</i>	<i>17.6</i>	<i>736.99</i>	<i>2.34</i>		
<i>CV</i> ³	<i>1.5</i>	<i>19.1</i>	<i>15.5</i>	<i>10.4</i>		

¹% Conversion is yield of succulent beans divided by total plant biomass. ²Means followed by the same letter are not significantly different according to Fisher's LSD. ³Coefficient of Variation.

Table 2. Days to Harvest, % Stand, Yield, % Conversion, Seed Color and Other Traits for the Irrigated 1st Year Trial of Baby Lima Bean Breeding Lines Planted June 24, 2021

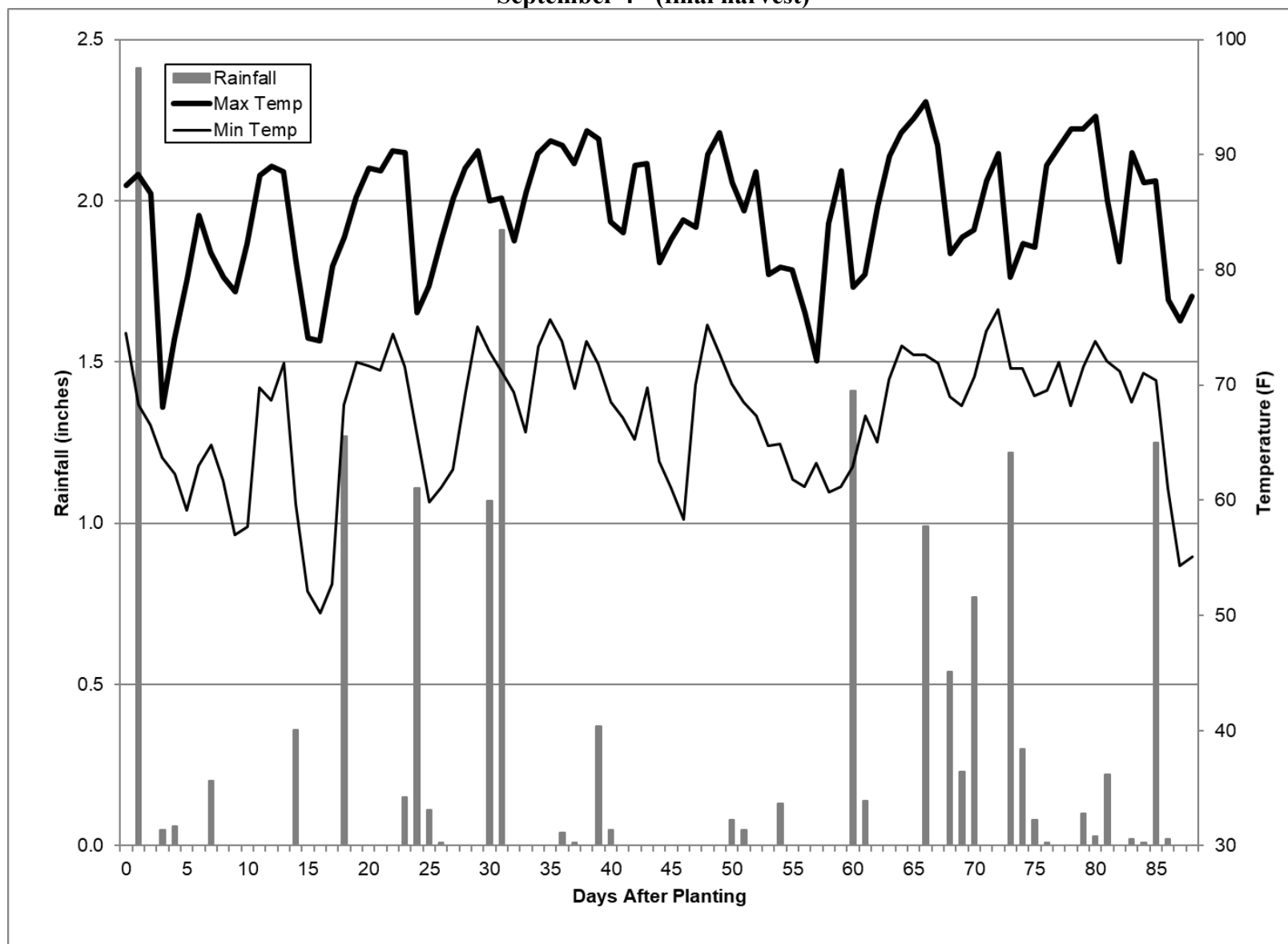
Variety	DTH	% Stand	Yield (lbs/acre)	% Conversion ¹	Seed Color	Other Traits
DE1600204A	78.3 c-e	90.3 a-f	4035 a	18.3 a	green	
DE1602902A	77.3 d-g	90.3 a-f	3877 ab	16.0 a-e	buff/purple speckle	pcap
DE1602908A	78.3 c-e	99.3 a	3722 abc	17.7 ab	red/dk red speckle	
DE1600801C	77.3 d-g	82.0 a-h	3576 a-d	16.3 a-d	wt green	
DE1603001A	80.0 abc	77.0 c-h	3481 a-e	16.7 a-d	red/purple speckle	
DE1603003C	81.0 ab	82.7 a-h	3444 a-f	17.0 abc	wt green	
DE1602203A I	77.0 d-h	80.3 b-h	3357 a-g	17.0 abc	buff/purple speckle	
DE1600103D	76.0 f-k	80.3 b-h	3253 a-h	15.3 a-f	green	
DE1602502D	76.0 f-k	80.3 b-h	3173 a-i	15.0 b-f	buff/purple hilum	
DE1602505B	75.0 h-k	82.0 a-h	3123 a-j	14.3 c-f	red/purple speckle	
DE1602501F	76.0 f-k	82.0 a-h	3085 b-j	15.3 a-f	green/hilum mix	
DE1603001C	76.0 f-k	91.0 a-f	3064 b-k	15.0 b-f	red/purple speckle	
DE1602204A	78.0 c-f	82.7 a-h	2980 b-l	16.7 a-d	red/dk red speckle	pcap
DE1602504E	75.3 g-k	70.3 hij	2929 c-l	15.3 a-f	burgundy/black	
DE1602203A II	75.7 g-k	70.3 hij	2913 c-m	16.7 a-d	buff/purple speckle	
DE1601001A II	76.7 e-i	68.0 hij	2909 c-m	15.0 b-f	green	A+
DE1602901A	81.0 ab	78.7 b-h	2903 c-m	14.7 b-f	buff/purple speckle	pcap
DE1602202C	77.3 d-g	73.7 e-i	2885 c-n	15.3 a-f	buff/purple speckle	
DE1602907A	75.0 h-k	96.3 ab	2829 c-n	14.3 c-f	red/purple speckle	A+
DE1600202A	74.3 jk	78.7 b-h	2754 d-n	15.0 b-f	green	pcap
DE1600204B	81.0 ab	72.7 f-i	2706 d-o	16.0 a-e	green	
DE1600202D	74.3 jk	76.3 c-h	2662 d-o	15.0 b-f	green	pcap
DE1603005A	77.3 d-g	81.3 a-h	2627 e-o	13.7 def	wt green	pcap
DE17215A	76.7 e-i	89.3 a-g	2574 e-o	14.0 c-f	wt green	willow
DE1601001A I	76.3 e-j	79.3 b-h	2558 f-o	16.3 a-d	lt green	
DE1601003C	74.0 k	92.7 a-d	2549 f-p	15.7 a-f	buff/magenta hilum	
DE1601002B	74.7 ijk	82.7 a-h	2525 g-p	16.0 a-e	lt green	
Emperor	77.3 d-g	53.7 j	2506 g-p	15.3 a-f	green	pcap
Cypress	75.3 g-k	66.0 hij	2497 g-p	14.0 c-f	green	pcap
DE1602201A	74.3 jk	91.0 a-f	2433 h-p	15.0 b-f	red/dk red speckle	
DE1600102C	75.0 h-k	74.3 d-i	2269 i-p	16.0 a-e	green	
DE1600103A	76.7 e-i	73.7 e-i	2255 j-p	17.0 abc	lt green	
DE1602304B	76.3 e-j	93.7 abc	2155 k-p	12.7 fg	wt green	
DE1600804C	79.0 b-d	64.3 hij	2111 l-p	14.0 c-f	green	
C-elite Select	82.0 a	91.3 a-e	1997 m-p	9.7 gh	green	pcap
DE1600202C	75.0 h-k	71.0 g-j	1972 nop	13.0 ef	green	pcap
DE1600102D	75.3 g-k	57.0 ij	1797 op	14.3 c-f	green	pcap
DE1600204C	77.3 d-g	73.7 e-i	1642 p	8.7 h	green	
p-value	<0.0001	0.0003	<0.0001	<0.0001		
LSD²	2.26	18.39	916.4	3.09		
CV³	1.8	14.2	20.2	12.6		

¹0% Conversion is yield of succulent beans divided by total plant biomass. ²Means followed by the same letter are not significantly different according to Fisher's LSD. ³Coefficient of Variation.

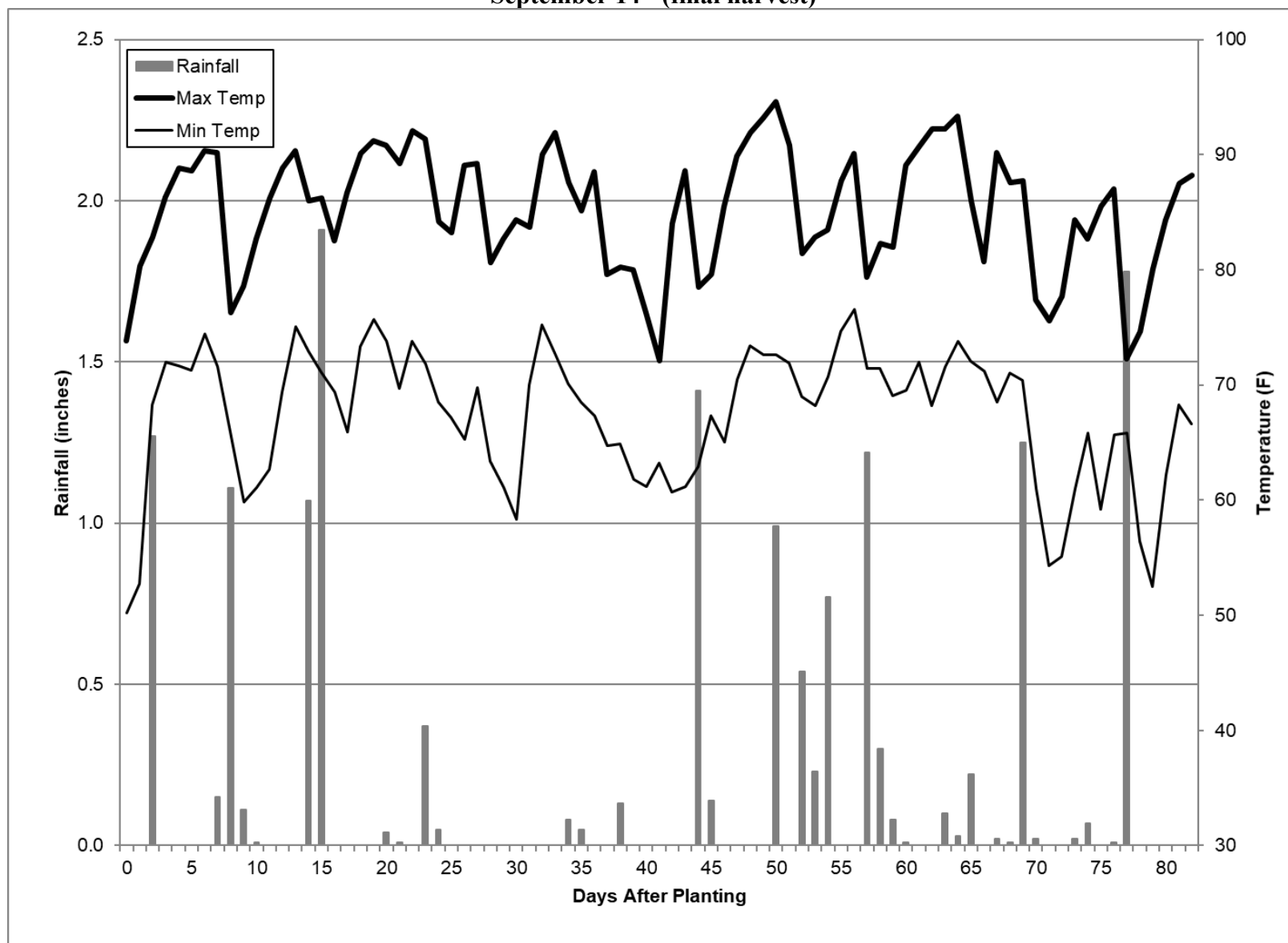
Table 3. Days to Harvest, % Stand, Yield, % Conversion, Seed Color, Gallling Rating and Other Traits Single Plot Lima Bean Breeding Lines Planted June 24, 2021

Variety	DTH	% Stand	Lbs/A	% Conversion	Seed Color	Galling Rating	Other Traits
DE16040402B	84	85.0	4863	18.1	red/black speckle	0.0	HT
DE16037234B	82	87.5	4540	16.2	green	-	HT
DE16040388B	81	77.5	4287	20.7	green	7.9	HT
DE16039304A	81	85.0	4183	19.9	dk red	0.0	HT
DE16042592A	75	77.5	3949	14.8	wt green	5.0	HT
DE1712127932B	82	80.0	3807	16.2	green	7.0	F
DE16042582B	75	97.5	3757	16.6	red	0.0	HT
DE1712103616A	84	100.0	3665	12.7	buff/purple speckle	0.0	F
DE16040402A	81	95.0	3657	14.0	red/dk red speckle	0.0	HT
DE16040388A	75	80.0	3607	17.6	lt green	6.7	HT
DE1712107648A	75	90.0	3595	15.6	wt green	6.3	F
DE1712127928A	84	110.0	3572	12.7	green	0.3	F
DE16042513S	81	72.5	3569	18.8	wt green	-	HT
DE1712129948A	84	60.0	3415	13.4	green	0.0	F
DE16039334B	81	67.5	3273	17.8	lt green	3.0	HT
DE16038254A	81	70.0	3111	17.2	wt green	-	HT
DE16042475B	76	87.5	3104	16.3	wt green	0.0	HT
DE16038274B	81	67.5	3019	18.1	lt green	5.8	HT
DE16042475A	75	60.0	2962	17.2	wt green	0.0	HT
DE16040373A	81	62.5	2904	19.1	green	0.0	HT
DE16040410B	76	50.0	2835	16.9	green	-	HT
DE16037210B	84	40.0	2724	16.1	green	0.0	HT
DE16039301A	84	37.5	2677	18.8	buff/purple speckle	0.0	HT
DE16039337A	75	77.5	2654	14.4	buff/purple speckle	0.0	HT
DE1712114711B	84	77.5	2581	15.2	red/black speckle	3.7	HT F
DE16038271B	81	62.5	2535	15.4	green	-	HT
DE16040440B	81	32.5	2147	15.1	green	-	HT

Appendix A: Weather Conditions During the 2021 Irrigated Advanced Baby Lima Variety Trial June 8th (planting) to September 4th (final harvest)



Appendix B: Weather Conditions During the 2021 Irrigated 1st Year Baby Lima Variety Trial June 24th (planting) to September 14th (final harvest)



2021 Fordhook Lima Bean Variety Trial

The 2021 Fordhook Lima Bean Variety Trial included a total of 40 lines. Thirty-nine of the lines were from the University of Delaware lima bean breeding program. Fordhook 242 was included in the trial as a check variety. The purpose of this trial is to evaluate advanced Fordhook breeding lines and other available varieties for yield, maturity, and quality under Delaware growing conditions.

Variety Name	Description	Variety Name	Description
FH 242	commercial standard	DP16005 17 B	UD (3 reps)
DE0701301A	UD (3 reps)	DP16005 18 B	UD (3 reps)
DE0803801A	UD (3 reps)	DP16005 25 B	UD (3 reps)
DE0804404C	UD (3 reps)	DE17109 08 A	UD (3 reps)
DE1002703A	UD (3 reps)	DE17109 09 A	UD (3 reps)
DE1002703B	UD (3 reps)	DE1601506A	UD (2 reps)
DE1102103C	UD (3 reps)	DP16005 18 A	UD (2 reps)
DE1102201A	UD (3 reps)	DP16005 21 A	UD (2 reps)
DE1102209B	UD (3 reps)	DP16005 25 A	UD (2 reps)
DE1202301B	UD (3 reps)	DE17109 03 A	UD (2 reps)
DE1203402B	UD (3 reps)	DE17109 03 B	UD (2 reps)
DE1203502A	UD (3 reps)	DE17109 09 B	UD (2 reps)
DE1203502B I	UD (3 reps)	DE17109 10 A	UD (2 reps)
DE1203502B II	UD (3 reps)	Large Smooth B	UD (2 reps)
DE1307404	UD (3 reps)	Large Smooth A	UD (2 reps)
DE1307504C	UD (3 reps)	DP16005 17 A	UD (1 rep)
DE1307506	UD (3 reps)	DP16005 2 A	UD (1 rep)
DE1307507	UD (3 reps)	DP16005 2 B	UD (1 rep)
DE1307601C	UD (3 reps)	DP16005 8 A	UD (1 rep)
DE1307609	UD (3 reps)	DP1600501 II	UD (1 rep)

Location:

Field 2 at the University of Delaware Research and Education Center Farm, Georgetown, DE

Cultural Practices:

The trial was hand planted on June 24, 2021 into rows marked with a Monosem planter. None of the seed was treated. Varieties were planted in one-row plots with 30 inch between row spacing and 6 inch in-row spacing. Plots were 10 feet in length and arranged in a randomized complete block design with three replications. Some lines were not replicated three times because of lack of seed.

The field was fertilized with potassium before planting according to soil test results. An application of 1.25 pt/A Dual Magnum 17 gpa N SUL 33 (27-0-0-6S) (50 lbs/a of N) was made pre-emergence. Plots were sidedressed with 10 gpa N-SUL 33 (30 lb/A of N) on August 25. One cultivation and additional hand weeding were done to control weeds. Weed control in the trial was good. Mustang Max at 4 oz/A was applied on July 20 to control stinkbug and lygus.

Harvest:

As harvest approached, plants were visually evaluated for maturity and plots were harvested when the majority of the pods were filled. Not all replications for a variety were harvested on the same day. Harvest began on September 21 (89 DAP) and ended on October 11 (109 DAP).

All plants from each plot were harvested. The plants were cut off at soil level and weighed. Pods were stripped from the harvested plants from each plot and counted as full, flat or dry. The pulled pods were shelled in a Model 520 “TaMaCo” huller from Taylor Manufacturing Co., Inc., Moultrie, GA. Any remaining trash was removed from the shelled beans by hand and the cleaned beans were weighed to determine yield. Twenty succulent seeds were weighed to measure seed size.

Results and Discussion

This trial was planted on June 24 and experienced some heat stress during flowering in mid-August. There were statistically significant differences in yield between varieties in this trial (Figure 4 and Table 4). Six lines had significantly higher yield than Fordhook 242: DE1307601C, DE1102103C, DE1002703A f, DP 16005 17B, DP 16005 25 B and DE1307506.

Figure 4. Fordhook Lima Bean Varieties in the 2021 Trial by Yield, Days to Harvest and Seed Size*



* * Color of data label indicates seed color: **Green**, **Light Green**, **White**, **Red and White**. “f” at end of name =resistant to race F of downy mildew. Bubble size indicates relative seed weight (size)

Table 4. Days to Harvest, % Stand, Yield, % Conversion, % Full, Flat and Dry Pods, Weight of 20 Succulent Seeds and Seed Color for Varieties in the 2021 Fordhook Variety Trial

Variety	DTH	% Stand	Yield (lbs/acre)	% Conversion ¹	% Full Pods	% Flat Pods	% Dry Pods	20 Seed Wt (g)	Seed Color
DE1307601C	90.3 ij	68.3 bcd	3294 a	16.7 bcd	75.9 a	11.2 fgh	12.9 fg	38.6 f-j	green
Large Smooth B	100.5 **	87.5 **	3188 **	12.8 **	56.2 **	9.1 **	34.7 **	25.4 **	green
DE1102103C	97.0 efg	63.3 c-e	3165 ab	15.0 cde	68.4 a-d	11.0 fgh	20.6 d-g	44.3 b-e	green
DE1002703A	91.0 hij	58.3 def	3046 abc	16.3 bcd	62.0 a-f	9.6 gh	28.4 c-f	39.2 e-i	green
DP16005 8 A	89.0 *	55.0 *	2977 *	19.6 *	42.5 *	1.2 *	56.3 *	44.4 *	white
Large Smooth A	100.5 **	50.0 **	2937 **	13.1 **	67.4 **	13.6 **	19.1 **	24.3 **	green
DP16005 18 A	89.0 **	62.5 **	2833 **	20.3 **	40.5 **	10.9 **	48.6 **	39.4 **	x-mas
DP16005 17 B	89.0 j	70.0 bcd	2777 a-d	22.3 a	42.5 ijk	7.4 h	50.1 ab	42.5 c-g	white
DP16005 25 B	89.0 j	88.3 a	2613 a-e	21.0 ab	32.5 kl	7.0 h	60.5 a	39.3 e-i	x-mas
DE1307506	100.3 cde	65.0 c-e	2590 a-f	12.3 d-h	48.8 f-j	17.5 c-h	33.6 cd	46.7 a-d	lt green
DP16005 17 A	89.0 *	75.0 *	2539 *	18.6 *	37.3 *	3.9 *	58.8 *	41.6 *	white
DE1601506A	93.0 **	70.0 **	2376 **	11.9 **	73.6 **	8.1 **	18.3 **	39.7 **	green
DE1203402B	91.0 hij	56.7 def	2375 b-g	14.0 d-g	74.8 ab	12.8 e-h	12.4 fg	37.3 g-j	green
DP16005 2 A	89.0 *	80.0 *	2332 *	21.2 *	43.5 *	2.2 *	54.3 *	44.5 *	white
DP16005 25 A	89.0 **	57.5 **	2295 **	16.7 **	46.5 **	12.0 **	41.5 **	42.2 **	white
DP16005 21 A	89.0 **	75.0 **	2255 **	18.2 **	35.7 **	8.7 **	55.6 **	35.8 **	x-mas
DE1307609	102.3 bc	45.0 fgh	2237 c-h	13.0 d-h	60.3 c-g	23.7 b-e	15.9 efg	41.3 d-h	green
DP16005 18 B	89.0 j	78.3 ab	2210 c-h	18.7 abc	27.8 l	8.3 h	63.9 a	39.5 e-i	x-mas
DE1002703B	93.7 ghi	56.7 def	2127 d-h	14.0 c-f	54.0 e-i	12.3 e-h	33.7 bce	38.4 f-j	green
DP16005 2 B	89.0 *	80.0 *	2040 *	12.0 *	22.8 *	6.3 *	70.9 *	43.2 *	white
DE1102209B	103.3 bc	46.7 fgh	1803 e-i	8.0 ghi	47.5 g-j	21.3 b-g	31.2 cde	49.2 ab	green
DP1600501 II	91.0 *	100.0 *	1725 *	16.4 *	25.9 *	25.9 *	48.3 *	39.8 *	x-mas
DE0803801A	104.7 b	66.7 c-e	1689 f-i	8.7 f-i	50.1 f-i	33.1 ab	16.8 efg	38.1 g-j	lt green
DE1102201A	103.3 bc	58.3 def	1639 ghi	8.0 ghi	53.9 e-i	24.3 b-e	21.8 d-g	50.8 a	green
<i>p-value</i>	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
<i>LSD</i> ²	3.8	16.63	918.8	5.36	14.39	12.14	16.5	5.43	
<i>CV</i> ³	2.4	18.6	28.1	25.5	15.4	42.0	39.2	8.0	

¹0% Conversion is yield of succulent beans divided by total plant biomass. ²Means followed by the same letter are not significantly different according to Fisher's LSD. ³Coefficient of Variation. * indicates date from only one plot, ** indicates average of two plots.

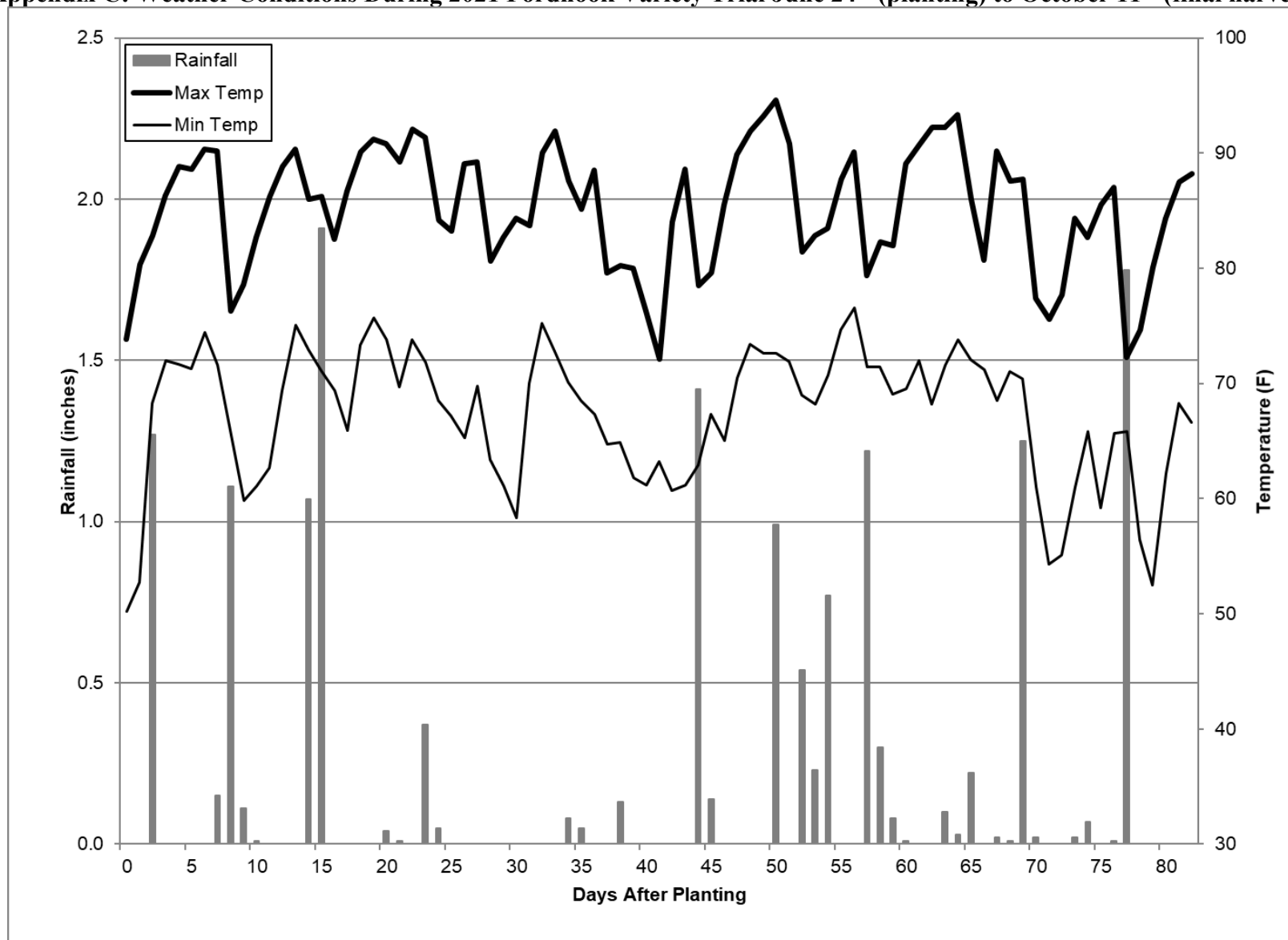
Table 4 continues on the next page.

Table 4 continued. Days to Harvest, % Stand, Yield, % Conversion, % Full, Flat and Dry Pods, Weight of 20 Succulent Seeds and Seed Color for Varieties in the 2021 Fordhook Variety Trial

Variety	DTH	% Stand	Yield (lbs/acre)	% Conversion ¹	% Full Pods	% Flat Pods	% Dry Pods	20 Seed Wt (g)	Seed Color
DE1202301B	109.0 a	75.0 abc	1539 ghi	6.0 i	45.8 h-k	39.3 a	14.9 efg	40.0 e-h	lt green
DE0701301A	101.0 bcd	60.0 c-e	1538 ghi	6.7 i	50.2 f-i	28.7 abc	21.0 d-g	46.8 abc	lt green
DE1203502A	94.3 fgh	25.0 i	1535 ghi	14.7 cde	70.6 a-d	13.2 e-h	16.2 efg	39.3 e-i	green
FH 242	101.0 bcd	68.3 bcd	1499 ghi	7.3 hi	58.9 d-h	18.1 c-h	23.0 c-g	41.3 d-h	lt green
DE1307507	99.7 cde	36.7 ghi	1474 ghi	8.7 f-i	61.2 b-g	16.5 d-h	22.2 d-g	41.6 c-h	green
DE1203502B I	97.0 efg	35.0 hi	1449 hi	12.7 d-h	72.6 a-d	18.0 c-h	9.4 g	36.9 hij	green
DE1307404	98.0 def	51.7 efg	1437 hi	10.7 e-i	34.8 jkl	26.0 bcd	39.2 bc	43.8 b-f	x-mas
DE1307504C	93.7 ghi	26.7 i	1394 hi	14.3 cde	75.2 ab	11.6 fgh	13.3 fg	33.7 j	green
DE1203502B II	94.3 fgh	25.0 i	1201 i	12.3 d-h	65.5 a-e	22.7 b-f	11.8 g	41.5 c-h	green
DE0804404C	93.7 ghi	26.7 i	1138 i	12.7 d-h	73.8 abc	10.2 gh	16.1 efg	34.2 ij	green
<i>p-value</i>	<i><0.0001</i>	<i><0.0001</i>	<i><0.0001</i>	<i><0.0001</i>	<i><0.0001</i>	<i><0.0001</i>	<i><0.0001</i>	<i><0.0001</i>	
<i>LSD</i> ²	<i>3.8</i>	<i>16.63</i>	<i>918.8</i>	<i>5.36</i>	<i>14.39</i>	<i>12.14</i>	<i>16.5</i>	<i>5.43</i>	
<i>CV</i> ³	<i>2.4</i>	<i>18.6</i>	<i>28.1</i>	<i>25.5</i>	<i>15.4</i>	<i>42.0</i>	<i>39.2</i>	<i>8.0</i>	

¹% Conversion is yield of succulent beans divided by total plant biomass. ²Means followed by the same letter are not significantly different according to Fisher's LSD. ³Coefficient of Variation.

Appendix C: Weather Conditions During 2021 Fordhook Variety Trial June 24th (planting) to October 11th (final harvest)



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