

**UNIVERSITY OF
DELAWARE**



LIMA BEAN

VARIETY

TRIAL

RESULTS

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2018

2018 UNIVERSITY OF DELAWARE GREEN BABY LIMA BEAN VARIETY TRIALS

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In 2018 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 Baby Lima Bean Variety Trial at Georgetown, DE – Planted June 29, 2018

The Irrigated Baby Lima Bean Variety Trial was planted on June 29 and included a total of 49 lines. Twelve of the lines were entered by ADM Seedwest. Thirty-three 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 29, 2018

Variety Name	Source	Variety Name	Source
Brooke (DE0407905)	University of Delaware	DE1305203A	University of Delaware
Bert (DE0407907)	University of Delaware	DE1305204A	University of Delaware
DE0505002A	University of Delaware	DE1305405B	University of Delaware
DE0802101A	University of Delaware	DE1305601B	University of Delaware
DE0802102A	University of Delaware	DE1305601C	University of Delaware
DE1000701B	University of Delaware	DE1307704A	University of Delaware
DE1001102E	University of Delaware	DE1306925	University of Delaware
DE1001202B	University of Delaware	DE13070103	University of Delaware
DE1001202C	University of Delaware	G1055283	ADM
DE1001202E	University of Delaware	G200381	ADM
DE1001802A	University of Delaware	G200382	ADM
DE1200307B	University of Delaware	G9005036	ADM
DE1200309C	University of Delaware	G3019326	ADM
DE1201101A	University of Delaware	G6017155	ADM
DE1202203A	University of Delaware	G6018138	ADM
DE1202205A	University of Delaware	G6019144	ADM
DE1202305B	University of Delaware	G6017139	ADM
DE1202606A	University of Delaware	G6019142	ADM
DE1202802C	University of Delaware	G6017148	ADM
DE1304304	University of Delaware	G6019134	ADM
DE1304306	University of Delaware		
DE1304401C	University of Delaware	Meadow	ADM (standard variety)
DE1304503	University of Delaware	Cypress	ADM (standard variety)
DE1304703A	University of Delaware	C-elite Select	Ben Fish (standard variety)
DE1304803A	University of Delaware	184-85	Ben Fish (standard variety)

Location:

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

Cultural Practices:

The trial was planted on June 29, 2018 with a Kinze cone planter. Some of the seed was treated, and some was not, as indicated in the results section. Varieties were planted in one-row plots with 30 inch between row spacing and 3 inch in-row spacing. Eight varieties (which are indicated in the results section) were planted at a higher seeding rate (5.3 seeds per foot) because of low germination. 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 (0-0-63-29S-7B) before planting according to soil test results. An application of 1.5 pt/A Dual II Magnum for weed control as well as 20 gpa N SUL 33 (27-0-0-6S) was made pre-emergence. Plots were cultivated and sidedressed with 10 gpa 30% UAN. Additional hand weeding was done as necessary. Weed control in the trial was excellent. Phostrol at 2 pt/a + Warrior 2 oz/A was applied on August 14, 2018.

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 7 (70 DAP) and ended on September 21 (84 DAP).

A 15-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. A random sample of 100 succulent beans was weighed to determine 100 bean weight as a means of bean size comparison.

**Irrigated First Year Trial of Baby Lima Breeding Lines at Georgetown, DE –
Planted July 6, 2018**

The Irrigated First Year Trial of Baby Lima Bean Breeding Lines was planted on July 6 and included a total of 32 lines. Thirty-one 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 in a replicated trial for the first time. The other two 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 First Year Trial of Baby Lima Breeding Lines, Planted July 6, 2018

Variety Name	Description	Variety Name	Description
Cypress	commercial standard	DE1304902	UD Breeding Line
C-elite Select	commercial standard	DE1304903	UD Breeding Line
DE1305203B	UD Breeding Line	DE1304904	UD Breeding Line
DE1305203C	UD Breeding Line	DE1304905	UD Breeding Line
DE1305205A	UD Breeding Line	DE1305102	UD Breeding Line
DE1305301B	UD Breeding Line	DE1305401	UD Breeding Line
DE1305403C	UD Breeding Line	DE1305402	UD Breeding Line
DE1305603A	UD Breeding Line	DE1305405	UD Breeding Line
DE1305603B	UD Breeding Line	DE1306863	UD Breeding Line
DE1306001A	UD Breeding Line	DE1306504	UD Breeding Line
DE1306001B	UD Breeding Line	DE1306563	UD Breeding Line
DE1306002A	UD Breeding Line	DE1307144	UD Breeding Line
DE1306002B	UD Breeding Line	DE1306583	UD Breeding Line
DE1306002C	UD Breeding Line	DE1306635	UD Breeding Line
DE1306003A	UD Breeding Line	DE1306927	UD Breeding Line
DE1304901	UD Breeding Line	DE0505002A	UD Breeding Line

Location:

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

Cultural Practices:

The trial was planted by hand on July 6, 2018. Some of the seed was treated, and some was not, as indicated in the results section. Varieties were planted in one-row plots with 30 inch between row spacing and 3 inch in-row spacing. Plots were 15 feet in length. The variety ‘Cypress’ was as a border for the outside rows. Plots were arranged in a randomized complete block design with three replications. The field was fertilized with potassium (0-0-63-29S-7B) before planting according to soil test results. An application of 1.5 pt/A Dual II Magnum for weed control as well as 20 gpa N SUL 33 (27-0-0-6S) was made pre-emergence. Plots were cultivated and sidedressed with 10 gpa 30% UAN. Additional hand weeding was done as necessary. Weed control in the trial was excellent. Phostrol at 2 pt/a + Warrior 2 oz/A was applied on August 14, 2018.

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 24 (80 DAP) and ended on October 1 (87 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. A random sample of 100 succulent beans was weighed to determine 100 bean weight as a means of bean size comparison.

Results and Discussion of the Baby Lima Trials at Georgetown

Weather, Pod Set and Maturity for the Baby Lima Trials

In the Advanced Trial, which was planted June 19, days to harvest for the standard varieties were below historical lows for this trial, indicating that plants were able to set pods at an early point in the growing season. Because of wet field conditions, this trial was planted at the end of June, rather than in early June as in past years. The later planting date may also have affected the days to harvest. The Advanced Trial had some cooler nights during the early reproductive period (20 DAP) which may have allowed for early pod set. The 1st Year Trial was planted one week later and experienced high nighttime temperatures during the reproductive period until 50 DAP. Days to harvest for Cypress and C-elite Select were 81 and 83 days respectively, closer to what has been observed in past years with high July temperatures. A comparison of days to harvest for the standard varieties versus the historical average is as follows:

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

Wet weather during the harvest period (5.5 inches of rain over two weeks) caused yield loss from lima bean pod rot (*Phytophthora capsici*) and Pythium blight in later maturing varieties in the Advanced trial and in all varieties in the 1st Year Trial.

Yield and Maturity in the June 29 Planted Advanced Baby Lima Trial

The purpose of the baby lima trial was to evaluate advanced breeding material from the University of Delaware, as well as varieties available from the two companies supplying lima seed in Delaware, under irrigated conditions. There were significant differences in yield between the varieties in this trial (Table 1). Yields were average to low in this trial. The highest

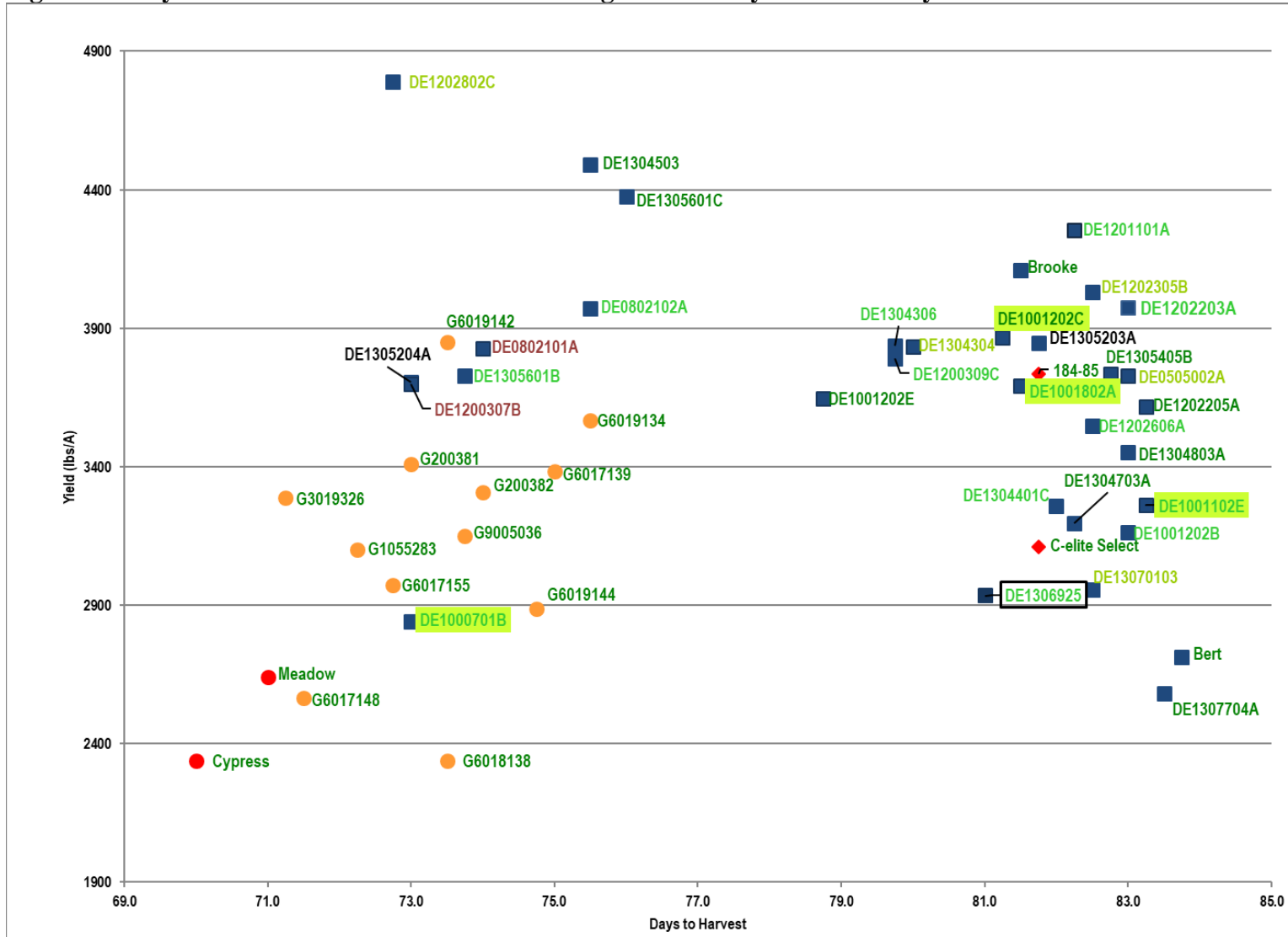
yielding entry in the 2018 trial was DE1202802C. It was the only variety to produce significantly higher yields than all four standard varieties (Cypress, C-elite Select, 184-85 and Meadow). DE1304503, DE1305601C, DE1201101A and Brooke (DE0407905) produced significantly higher yields than C-elite Select, Cypress and Meadow. Of the top yielding varieties, DE1304503, DE1305601C and Brooke have high quality green seed (Figure 1).

Among the varieties entered by ADM, G601942 was the highest yielding entry and G3019326 was the earliest maturing. G601942 had significantly higher yield than both Cypress and Meadow. G200382, which performed well in past years trials yielded 3308 lbs/A and matured in 74 days.

One characteristic desirable in a variety is uniform maturity across the field. The rate of maturity of some varieties is more affected by variations in field conditions (i.e. soil type, drainage, variable stand) than others. Standard deviation is a statistic used to describe the average difference between several individual observations and their mean (or average). The standard deviation of days to harvest for the replicated varieties in trial is given in Table 2. Varieties with the lowest standard deviation of days to harvest are those matured most uniformly across the field. The standard deviation of days to harvest was low for most entries this year as across field variability was minimal in this trial. For varieties with higher standard deviation of days to harvest it may be more difficult to determine when to harvest the field for maximum yield and quality.

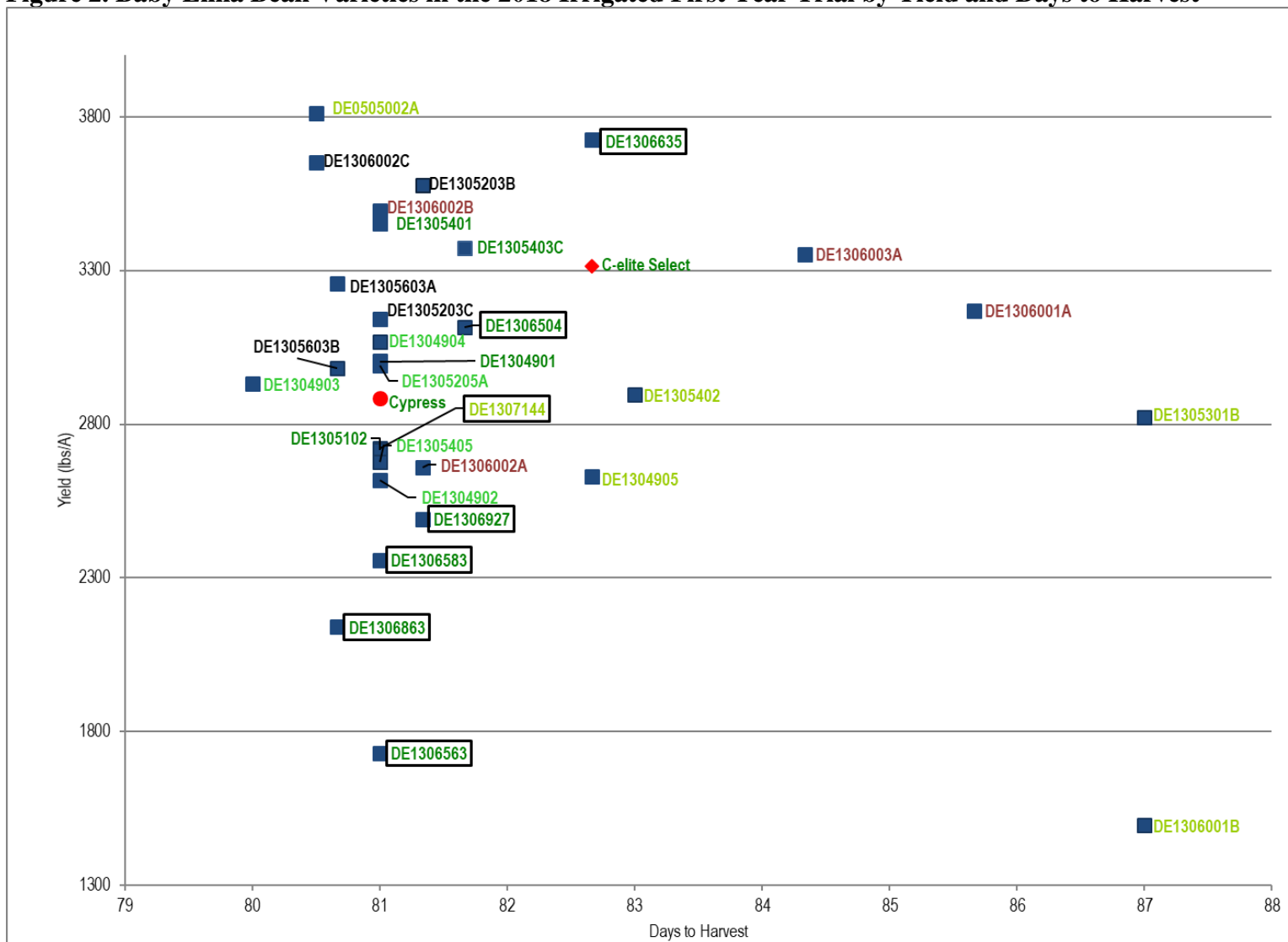
As in past years, breeding lines that were being evaluated for the first time were tested in a separate trial. The Irrigated First Year Trial was planted one week later than the irrigated advanced trial. Yields of standard varieties in this trial were comparable to those in the Irrigated Advanced Trial. The results from this trial are in Table 4. This trial included seven breeding lines with resistance to root knot nematode as determined in a separate, inoculated field screen (Table 5 and Figure 3). Fourteen of the lines from this trial will be advanced to evaluation in the main irrigated trial in 2019: DE1306635, DE1306002C, DE1305203B, DE1306002B, DE1305401, DE1305403C, DE1306003A, DE1306001A, DE1305203C, DE1306504, DE1304904, DE1304903, DE1306927, DE1306583.

Figure 1. Baby Lima Bean Varieties in the 2018 Irrigated Trial by Yield and Days to Harvest*



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

Figure 2. Baby Lima Bean Varieties in the 2018 Irrigated First Year Trial by Yield and Days to Harvest*



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

Table 1. Days to Harvest, Yield, Maturity at Harvest, Pods per Plant, Percent Conversion, and Percent Stand for the Irrigated Baby Lima Bean Variety Trial Planted June 29, 2018

Variety ¹	Days to Harvest	Yield (Lbs/A)	% Conversion	% Stand ²
DE1202802C	72.8 g-k	4790 a	19.5 a	86.7 a-g
DE1304503	75.5 fg	4492 ab	16.5 b-f	84.2 a-j
DE1305601C	76.0 ef	4376 a-c	16.4 b-f	85.8 a-i
DE1201101A	82.3 a-c	4253 a-d	16.8 b-e	90.4 a-d
Brooke	81.5 a-d	4111 a-e	15.0 c-j	75.4 e-k
DE1202305B	82.5 a-c	4030 a-f	16.8 b-e	86.2 a-h
DE1202203A	83.0 a	3976 a-f	17.3 a-c	81.3 b-j
DE0802102A	75.5 fg	3972 a-f	14.6 d-k	77.5 d-k
DE1001202C	81.3 a-d	3866 a-g	15.0 c-j	87.9 a-e
G6019142*	73.5 f-j	3850 a-h	17.8 ab	72.1 i-l
DE1305203A	81.8 a-c	3846 a-h	16.3 b-g	75.8 e-k
DE1304306	79.8 cd	3837 a-h	16.6 b-f	78.8 d-k
DE1304304	80.0 b-d	3833 a-h	17.4 a-c	84.2 a-j
DE0802101A	74.0 f-i	3826 a-h	16.0 b-h	94.2 a-c
DE1200309C	79.8 cd	3792 b-i	16.5 b-f	78.8 d-k
184-85	81.8 a-c	3736 b-i	12.9 j-o	83.3 a-j
DE1305405B	82.8 ab	3736 b-i	17.2 a-d	82.9 a-j
DE1305601B	73.8 f-j	3729 b-i	12.8 j-o	90.0 a-d
DE0505002A	83.0 a	3727 b-i	14.9 c-j	82.9 a-j
DE1305204A	73.0 g-j	3705 b-i	14.7 d-k	80.8 b-j
DE1200307B	73.0 g-j	3698 b-i	15.3 b-j	94.6 ab
DE1001802A	81.5 a-d	3693 b-i	15.9 b-h	78.8 d-k
DE1001202E	78.8 de	3646 b-j	13.6 h-n	79.2 d-k
DE1202205A	83.3 a	3616 b-j	14.0 f-m	83.3 a-j
G6019134*	75.5 fg	3568 b-k	15.4 b-j	83.3 a-j
DE1202606A	82.5 a-c	3548 b-k	15.7 b-i	80.4 c-j
DE1304803A	83.0 a	3452 c-l	14.6 d-k	83.3 a-j
G200381	73.0 g-j	3409 d-l	16.1 b-h	61.3 l-n
G6017139*	75.0 f-h	3383 d-l	12.1 k-o	96.1 a
G200382*	74.0 f-i	3308 d-l	16.2 b-h	70.8 j-l
G3019326*	71.3 i-k	3287 e-m	16.9 a-e	53.8 m-o
DE1001102E	83.3 a	3261 e-m	11.8 m-o	78.3 d-k
DE1304401C	82.0 a-c	3257 e-m	15.9 b-h	78.8 d-k
DE1304703A	82.3 a-c	3195 e-m	14.4 e-l	74.2 e-l
DE1001202B	83.0 a	3162 e-m	11.4 no	80.0 d-k
G9005036	73.8 f-j	3151 e-m	14.3 e-m	55.4 m-o
C-elite Select	81.8 a-c	3110 f-m	12.3 k-o	85.0 a-i
G1055283	72.3 h-k	3100 f-m	14.6 d-k	70.4 j-l
G6017155*	72.8 g-k	2973 g-m	13.7 g-n	72.5 h-l
DE13070103	82.5 a-c	2956 g-m	15.3 b-j	73.8 f-l
DE1306925	81.0 a-d	2937 g-m	15.1 c-j	73.3 g-l
G6019144*	74.8 f-h	2887 h-m	11.9 l-o	78.3 d-k
DE1000701B	73.0 g-j	2842 i-m	10.4 o	87.5 a-f
<i>p-value</i>	<0.0001	<0.0001	<0.0001	<0.0001
Fisher's LSD ³	2.91	965.3	2.63	13.89
C.V. ⁴	2.68	19.90	12.78	12.80

¹Varieties highlighted and in bold are resistant to race F of downy mildew. Asterisk indicates that a higher seeding rate was used for this variety ²Percent stand is highlighted for varieties for which treated seed was planted. ³Means followed by the same letter are not significantly different according to Fisher's LSD. ⁴Coefficient of Variation.

Table 1 continues on the next page.

Table 1 Continued. Days to Harvest, Yield, Maturity at Harvest, Pods per Plant, Percent Conversion, and Percent Stand for the Irrigated Baby Lima Bean Variety Trial Planted June 29, 2018

Variety ¹	Days to Harvest	Yield (Lbs/A)	% Conversion	% Stand ²
Bert	83.8 a	2714 j-m	11.9 l-o	82.5 a-j
Meadow	71.0 jk	2640 k-m	13.1 i-o	48.9 no
DE1307704A	83.5 a	2581 lm	11.2 no	86.7 a-g
G6017148*	71.5 i-k	2565 lm	13.2 i-n	66.3 k-m
Cypress	70.0 k	2338 m	12.3 k-o	47.5 no
G6018138*	73.5 f-j	2338 m	12.8 j-o	42.1 o
<i>p-value</i>	<0.0001	<0.0001	<0.0001	<0.0001
Fisher's LSD³	2.91	965.3	2.63	13.89
C.V.⁴	2.68	19.90	12.78	12.80

¹Varieties highlighted and in bold are resistant to race F of downy mildew. Asterisk indicates that a higher seeding rate was used for this variety ²Percent stand is highlighted for varieties for which treated seed was planted. ³Means followed by the same letter are not significantly different according to Fisher's LSD. ⁴Coefficient of Variation.

Table 2. Average Days to Harvest and Standard Deviation of Days to Harvest for the Irrigated Baby Lima Bean Variety Trial Planted June 29, 2018

Variety	Average Days to Harvest	Standard Deviation of Days to Harvest
Cypress	70.0	0.00
Bert	83.8	0.50
DE0802102A	75.5	0.58
DE1304503	75.5	0.58
G6019134	75.5	0.58
DE1202203A	83.0	0.82
DE1001102E	83.3	0.96
DE1202205A	83.3	0.96
DE1307704A	83.5	1.00
G6018138	73.5	1.00
DE0505002A	83.0	1.15
DE0802101A	74.0	1.15
DE1001202B	83.0	1.15
DE1304803A	83.0	1.15
G6019144	74.8	1.26
C-elite Select	81.8	1.26
G6017139	75.0	1.41
Meadow	71.0	1.41
DE1001202C	81.3	1.50
G1055283	72.3	1.50
DE1201101A	82.3	1.71
DE1304703A	82.3	1.71
G6017148	71.5	1.73
DE1305405B	82.8	1.89
Brooke	81.5	1.91
DE1001802A	81.5	1.91
DE1202305B	82.5	1.91
DE1202606A	82.5	1.91
DE13070103	82.5	1.91
DE1202802C	72.8	2.06
DE1305203A	81.8	2.06
184-85	81.8	2.06
DE1304401C	82.0	2.31
DE1200307B	73.0	2.45
DE1305204A	73.0	2.45
G200381	73.0	2.45
DE1305601B	73.8	2.50
G3019326	71.3	2.50
G6019142	73.5	2.65
G200382	74.0	2.71
DE1304304	80.0	2.83
DE1304306	79.8	2.87
G9005036	73.8	2.87
DE1305601C	76.0	2.94
G6017155	72.8	3.20
DE1200309C	79.8	3.30
DE1001202E	78.8	3.40

continued

Variety	Average Days to Harvest	Standard Deviation of Days to Harvest
DE1000701B	73.0	3.46
DE1306925	81.0	4.08

Standard Deviation of Days to Harvest

Standard deviation of days to harvest describes the average number of days between harvest of an individual plot of a variety and the overall average days to harvest for all of the plots of that variety. Varieties with low standard deviation of days to harvest, reached maturity at the same time. Varieties with high standard deviation of days to harvest did not mature uniformly.

Table 3. Yield and 100 Seed Weight for Varieties in the 2018 Irrigated Baby Lima Trial

Variety	Yield (lbs/A)	Weight of 100 Succulent Seeds (g)
DE0802101A	3826 a-h	88 a
DE1001802A	3693 b-i	84 ab
DE1202606A	3548 b-k	84 ab
DE1202205A	3616 b-j	83 ab
DE1001202B	3162 e-m	82 bc
DE1001102E	3261 e-m	81 b-d
DE1201101A	4253 a-d	77 c-e
G1055283	3100 f-m	77 c-f
Bert	2714 j-m	76 d-g
DE1304703A	3195 e-m	76 d-g
DE1304306	3837 a-h	75 d-h
DE1307704A	2581 lm	75 d-h
DE1305405B	3736 b-i	74 e-i
DE1001202C	3866 a-g	74 e-i
DE1202203A	3976 a-f	73 e-j
DE1202305B	4030 a-f	73 e-j
G6019144	2887 h-m	72 e-k
DE1304803A	3452 c-l	71 e-l
DE0802102A	3972 a-f	71 f-l
DE1304401C	3257 e-m	71 g-l
DE1304503	4492 ab	71 g-l
DE1200307B	3698 b-i	70 g-l
DE1304304	3833 a-h	70 g-l
DE1305601C	4376 a-c	70 g-l
184-85	3736 b-i	70 g-l
DE0505002A	3727 b-i	70 h-m
Meadow	2640 k-m	70 h-m
Brooke	4111 a-e	70 h-m
G6019142	3850 a-h	69 i-m
G6019134	3568 b-k	69 i-m
DE13070103	2956 g-m	68 j-n
DE1202802C	4790 a	68 j-o
DE1306925	2937 g-m	68 j-o
G200382	3308 d-l	67 k-p
DE1305601B	3729 b-i	67 k-p
G9005036	3151 e-m	67 k-p
C-elite Select	3110 f-m	67 k-q
G3019326	3287 e-m	66 k-q
DE1001202E	3646 b-j	66 k-q
G6018138	2338 m	66 l-q
G200381	3409 d-l	64 m-r
DE1200309C	3792 b-i	63 n-s
G6017139	3383 d-l	62 o-t

Table 4 continued

Variety	Yield (lbs/A)	Weight of 100 Succulent Seeds (g)
DE1000701B	2842 i-m	62 p-t
DE1305203A	3846 a-h	61 q-t
Cypress	2338 m	61 q-t
G6017155	2973 g-m	59 r-t
DE1305204A	3705 b-i	57 st
G6017148	2565 lm	57 t
<i>p-value</i>	<0.0001	<0.0001
Fisher's LSD¹	965.3	6.0
C.V.²	19.90	6.08

¹Means followed by the same letter are not significantly different according to Fisher's LSD.

²Coefficient of Variation.

Table 4. Days to Harvest, Yield, Percent Conversion, Percent Stand and Seed Weight for the Irrigated First Year Trial of Baby Lima Bean Breeding Lines Planted July 6, 2018

Variety	Days to Harvest ¹	Yield (Lbs/A) ¹	% Conversion ¹	% Stand ^{1,2}	Weight of 100 Succulent Seeds (g) ¹
DE0505002A	80.5 *	3811 *	14.3 *	98.8 *	73 *
DE1306635	82.7 de	3726 a	15.4 a-e	97.5 a	77 a-c
DE1306002C	80.5 *	3651 *	18.2 *	91.3 *	67 *
DE1305203B	81.3 ef	3578 ab	15.3 a-e	100.8 a	64 l-n
DE1306002B	81.0 f	3494 a-c	16.5 a	95.0 a	67 h-l
DE1305401	81.0 f	3453 a-c	14.7 a-f	93.3 a	74 b-e
DE1305403C	81.7 def	3372 a-d	14.8 a-f	98.3 a	66 i-m
DE1306003A	84.3 bc	3354 a-d	16.3 ab	96.7 a	76 a-d
C-elite Select	82.7 de	3315 a-e	13.6 c-g	94.2 a	72 d-g
DE1305603A	80.7 f	3255 a-f	15.8 a-c	100.0 a	66 j-m
DE1306001A	85.7 ab	3170 a-g	13.7 c-g	97.5 a	79 a
DE1305203C	81.0 f	3142 a-g	14.0 b-f	101.7 a	60 n
DE1306504	81.7 def	3116 a-h	15.8 a-c	99.2 a	78 ab
DE1304904	81.0 f	3067 b-h	15.6 a-d	99.2 a	69 f-j
DE1304901	81.0 f	3006 b-h	14.5 a-f	95.0 a	72 d-g
DE1305205A	81.0 f	2990 b-i	13.3 d-h	100.0 a	69 g-k
DE1305603B	80.7 f	2981 b-i	14.5 a-f	100.8 a	79 ab
DE1304903	80.0 **	2931 **	14.6 **	90.0 **	69 **
DE1305402	83.0 cd	2895 c-i	13.2 e-i	100.0 a	65 k-n
Cypress	81.0 f	2885 c-i	14.6 a-f	86.7 a	70 e-i
DE1305301B	87.0 a	2821 d-i	9.8 j	97.5 a	77 a-c
DE1307144	81.0 f	2721 e-j	15.4 a-e	95.8 a	69 f-j
DE1305102	81.0 f	2717 e-j	13.3 d-h	99.2 a	63 mn
DE1305405	81.0 f	2676 f-j	12.5 f-i	90.8 a	66 i-m
DE1306002A	81.3 ef	2661 f-j	15.4 a-e	96.7 a	66 i-m
DE1304905	82.7 de	2629 f-j	10.9 h-j	96.7 a	70 e-i
DE1304902	81.0 f	2619 g-j	13.6 c-g	95.0 a	74 c-f
DE1306927	81.3 ef	2492 h-j	13.7 c-g	96.7 a	70 f-j
DE1306583	81.0 f	2359 i-k	14.2 a-f	94.2 a	64 l-n
DE1306863	80.7 f	2140 jk	10.9 ij	100.8 a	71 e-h
DE1306563	81.0 f	1730 k	11.6 g-j	90.8 a	64 l-n
DE1306001B	87.0 **	1494 **	4.8 **	90.0 **	78 **
<i>p-value</i>	<0.0001	<0.0001	<0.0001	0.1373	<0.0001
Fisher's LSD³	1.55	631.9	2.37	N.S.	4.5
C.V.⁴	1.16	13.12	10.30	5.29	3.95

¹* indicates average of two reps, ** indicates data from a single plot

²Percent stand is highlighted for varieties for which treated seed was planted.

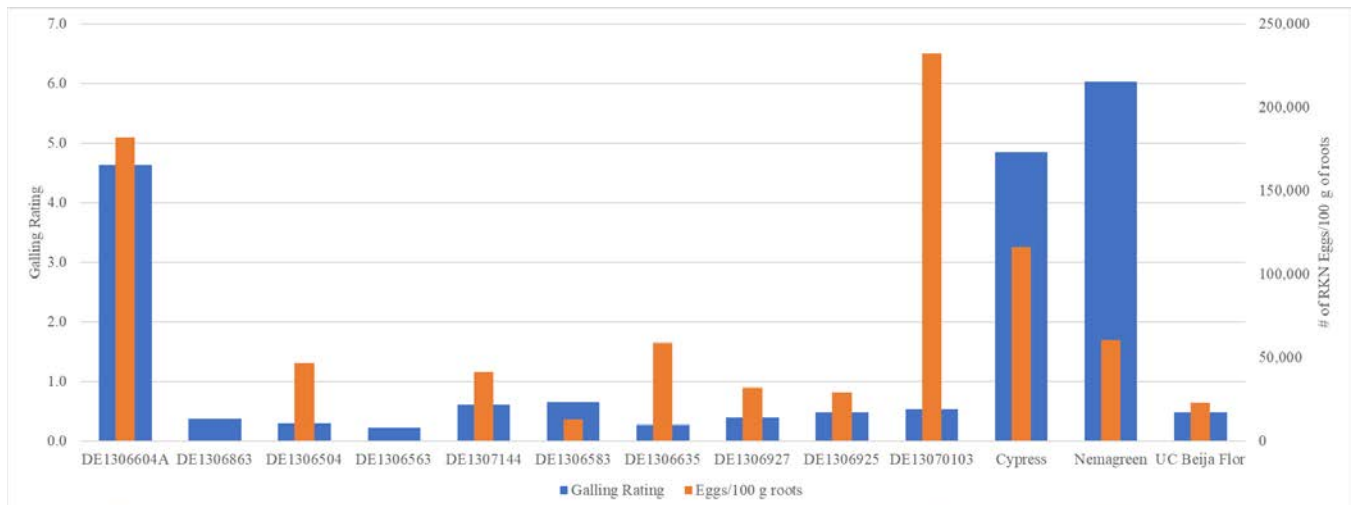
³Means followed by the same letter are not significantly different according to Fisher's LSD.

⁴Coefficient of Variation.

Table 5. Gallling Rating and Number of Extracted Eggs from Lima Bean Lines Field Screened for Root-Knot Nematode Resistance in 2018

Variety	Average Gallling Rating	Eggs/100 g Roots
DE1306604A	4.6	181,860
DE1306863	0.4	---
DE1306504	0.3	46,775
DE1306563	0.2	---
DE1307144	0.6	41,461
DE1306583	0.7	13,125
DE1306635	0.3	58,756
DE1306927	0.4	32,222
DE1306925	0.5	29,127
DE13070103	0.5	232,253
Cypress	4.9	116,312
Nemagreen	6.0	60,635
UC Beija Flor	0.5	22,778

Figure 3. Gallling Rating and Number of Extracted Eggs from Lima Bean Lines Field Screened for Root-Knot Nematode Resistance in 2018



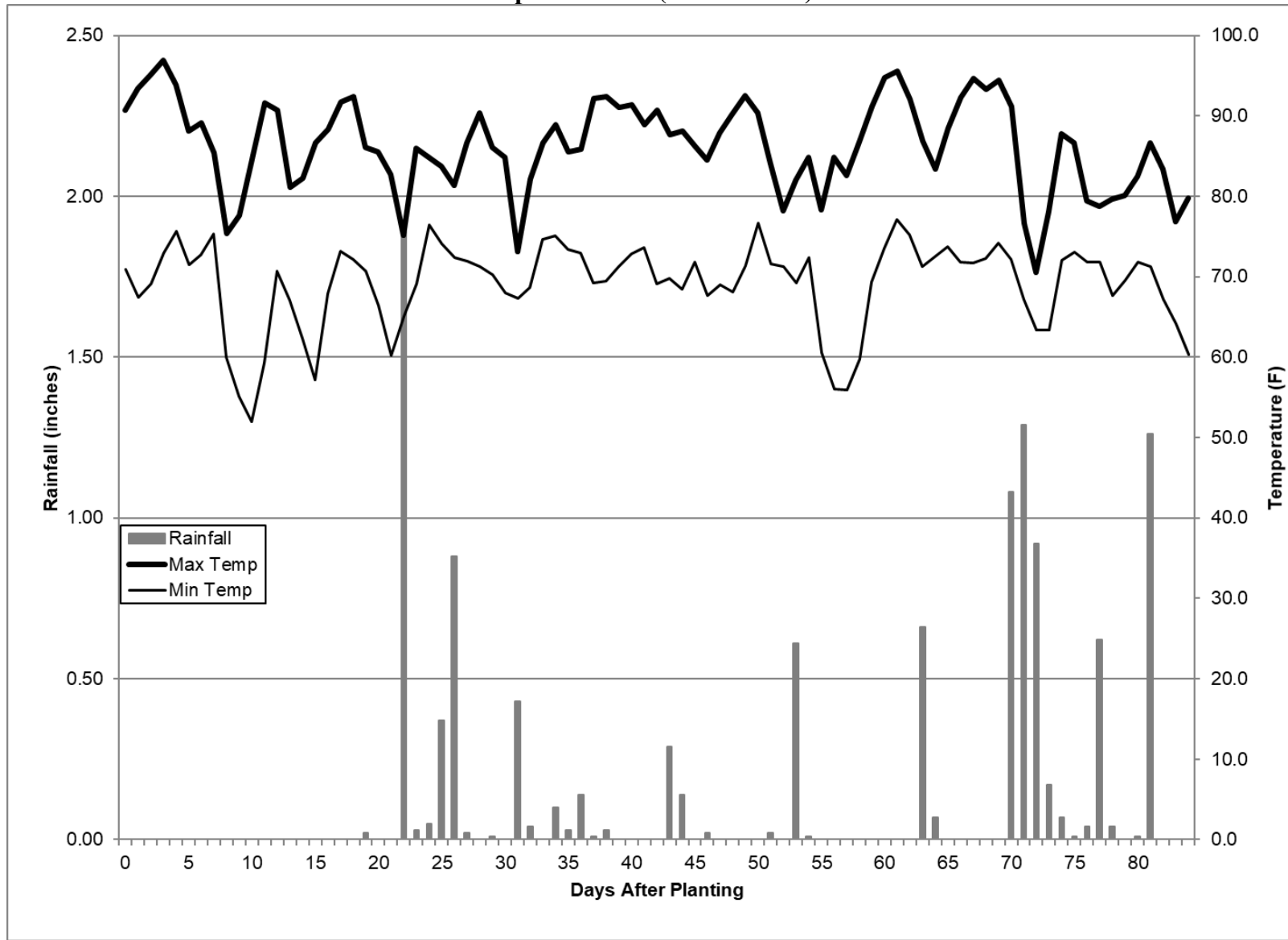
**Appendix A: Weather Data for 2018 Advanced Baby Lima Variety Trial at Georgetown
June 29th (planting) to September 21st (final harvest)**

Data from DEOS weather station @ Georgetown, DE-REC: www.deos.udel.edu

Date	Days After Planting	Max Temp °F	Min Temp °F	Rainfall (in.)
29-Jun	0	90.7	70.9	0
30-Jun	1	93.4	67.4	0
1-Jul	2	95.1	69.1	0
2-Jul	3	96.9	72.9	0
3-Jul	4	93.9	75.6	0
4-Jul	5	88.1	71.5	0
5-Jul	6	89.1	72.7	0
6-Jul	7	85.4	75.3	0
7-Jul	8	75.4	60.0	0
8-Jul	9	77.6	55.1	0
9-Jul	10	84.6	52.0	0
10-Jul	11	91.6	59.3	0
11-Jul	12	90.7	70.7	0
12-Jul	13	81.1	67.1	0
13-Jul	14	82.3	62.4	0
14-Jul	15	86.6	57.2	0
15-Jul	16	88.3	67.9	0
16-Jul	17	91.7	73.2	0
17-Jul	18	92.4	72.2	0
18-Jul	19	86.1	70.7	0.02
19-Jul	20	85.5	66.4	0
20-Jul	21	82.7	60.2	0
21-Jul	22	75.1	65.1	1.89
22-Jul	23	86.0	69.1	0.03
23-Jul	24	84.8	76.4	0.05
24-Jul	25	83.7	74.1	0.37
25-Jul	26	81.3	72.4	0.88
26-Jul	27	86.7	71.9	0.02
27-Jul	28	90.4	71.2	0
28-Jul	29	86.1	70.2	0.01
29-Jul	30	84.8	68.0	0
30-Jul	31	73.1	67.3	0.43
31-Jul	32	82.1	68.7	0.04
1-Aug	33	86.7	74.6	0
2-Aug	34	88.9	75.1	0.1
3-Aug	35	85.5	73.4	0.03
4-Aug	36	85.9	72.9	0.14
5-Aug	37	92.2	69.2	0.01
6-Aug	38	92.4	69.5	0.03
7-Aug	39	91.0	71.3	0
8-Aug	40	91.4	72.8	0
9-Aug	41	88.9	73.6	0
10-Aug	42	90.7	69.1	0
11-Aug	43	87.7	69.8	0.29
12-Aug	44	88.1	68.4	0.14
13-Aug	45	86.2	71.8	0
14-Aug	46	84.5	67.6	0.02
15-Aug	47	87.9	69.0	0
16-Aug	48	90.3	68.1	0
17-Aug	49	92.5	71.4	0

18-Aug	50	90.4	76.7	0
Date	Days After Planting	Max Temp °F	Min Temp °F	Rainfall (in.)
19-Aug	51	84.1	71.6	0.02
20-Aug	52	78.2	71.3	0
21-Aug	53	82.0	69.2	0.61
22-Aug	54	84.8	72.4	0.01
23-Aug	55	78.3	60.5	0
24-Aug	56	84.8	56.0	0
25-Aug	57	82.6	55.9	0
26-Aug	58	86.8	59.7	0
27-Aug	59	91.1	69.3	0
28-Aug	60	94.8	73.5	0
29-Aug	61	95.5	77.1	0
30-Aug	62	92.1	75.2	0
31-Aug	63	86.9	71.2	0.66
1-Sep	64	83.4	72.5	0.07
2-Sep	65	88.4	73.7	0
3-Sep	66	92.3	71.8	0
4-Sep	67	94.6	71.7	0
5-Sep	68	93.3	72.3	0
6-Sep	69	94.4	74.2	0
7-Sep	70	91.1	72.2	1.08
8-Sep	71	76.6	67.2	1.29
9-Sep	72	70.5	63.4	0.92
10-Sep	73	78.1	63.4	0.17
11-Sep	74	87.8	72.0	0.07
12-Sep	75	86.7	73.1	0.01
13-Sep	76	79.4	71.8	0.04
14-Sep	77	78.8	71.8	0.62
15-Sep	78	79.7	67.7	0.04
16-Sep	79	80.1	69.6	0
17-Sep	80	82.5	71.8	0.01
18-Sep	81	86.6	71.2	1.26
19-Sep	82	83.4	67.2	0
20-Sep	83	76.8	64.1	0
21-Sep	84	79.8	60.3	0

Appendix B: Weather Conditions During the 2018 Irrigated Advanced Baby Lima Variety Trial June 29th (planting) to September 21st (final harvest)



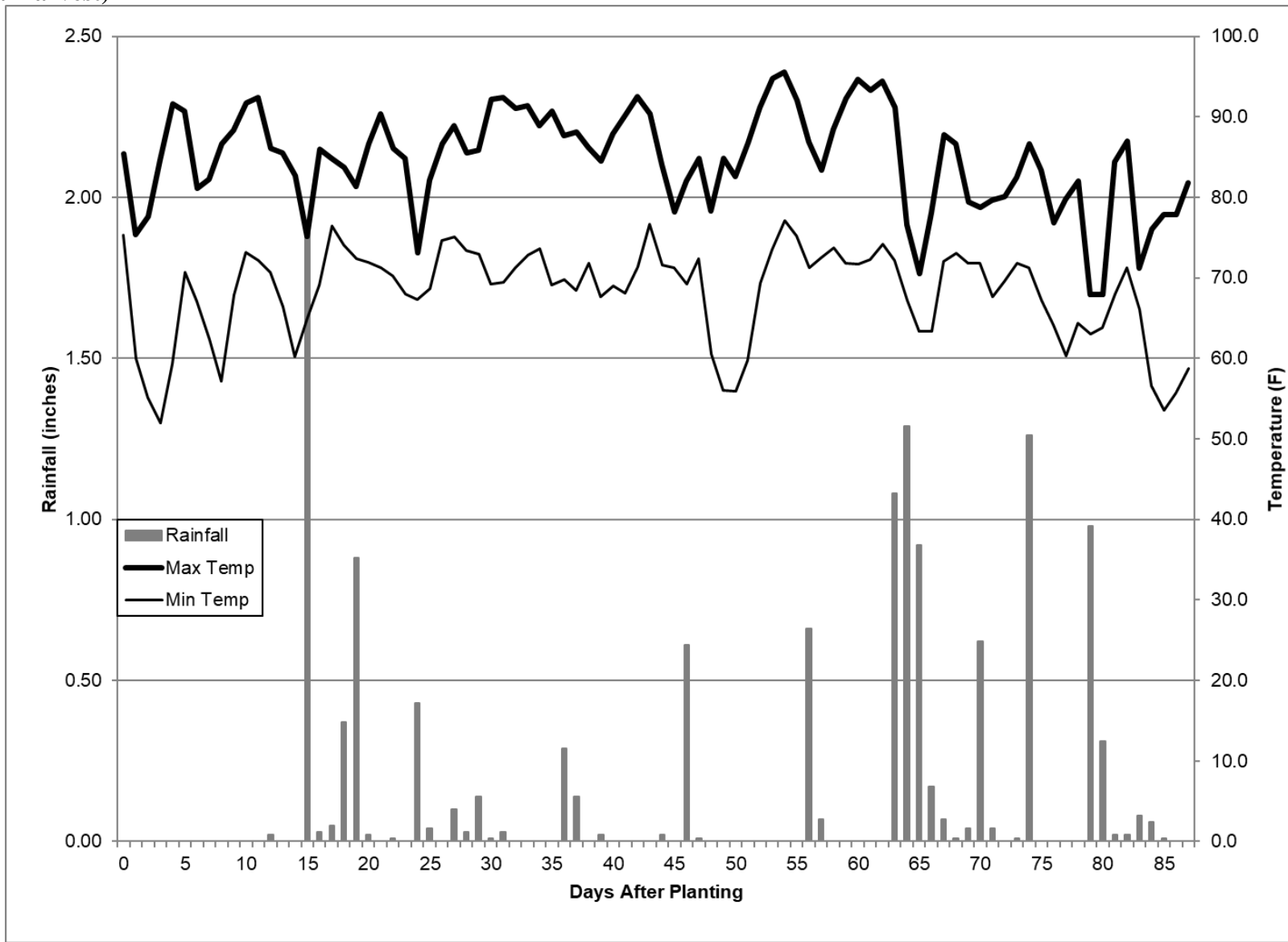
**Appendix C: Weather Data for 2018 First Year Baby Lima Variety Trial at Georgetown
July 6th (planting) to October 1st (final harvest)**

Data from DEOS weather station @ Georgetown, DE-REC: www.deos.udel.edu

Date	Days After Planting	Max Temp °F	Min Temp °F	Rainfall (in.)
6-Jul	0	85.4	75.3	0
7-Jul	1	75.4	60	0
8-Jul	2	77.6	55.1	0
9-Jul	3	84.6	52	0
10-Jul	4	91.6	59.3	0
11-Jul	5	90.7	70.7	0
12-Jul	6	81.1	67.1	0
13-Jul	7	82.3	62.4	0
14-Jul	8	86.6	57.2	0
15-Jul	9	88.3	67.9	0
16-Jul	10	91.7	73.2	0
17-Jul	11	92.4	72.2	0
18-Jul	12	86.1	70.7	0.02
19-Jul	13	85.5	66.4	0
20-Jul	14	82.7	60.2	0
21-Jul	15	75.1	65.1	1.89
22-Jul	16	86	69.1	0.03
23-Jul	17	84.8	76.4	0.05
24-Jul	18	83.7	74.1	0.37
25-Jul	19	81.3	72.4	0.88
26-Jul	20	86.7	71.9	0.02
27-Jul	21	90.4	71.2	0
28-Jul	22	86.1	70.2	0.01
29-Jul	23	84.8	68	0
30-Jul	24	73.1	67.3	0.43
31-Jul	25	82.1	68.7	0.04
1-Aug	26	86.7	74.6	0
2-Aug	27	88.9	75.1	0.1
3-Aug	28	85.5	73.4	0.03
4-Aug	29	85.9	72.9	0.14
5-Aug	30	92.2	69.2	0.01
6-Aug	31	92.4	69.5	0.03
7-Aug	32	91	71.3	0
8-Aug	33	91.4	72.8	0
9-Aug	34	88.9	73.6	0
10-Aug	35	90.7	69.1	0
11-Aug	36	87.7	69.8	0.29
12-Aug	37	88.1	68.4	0.14
13-Aug	38	86.2	71.8	0
14-Aug	39	84.5	67.6	0.02
15-Aug	40	87.9	69	0
16-Aug	41	90.3	68.1	0
17-Aug	42	92.5	71.4	0
18-Aug	43	90.4	76.7	0
19-Aug	44	84.1	71.6	0.02
20-Aug	45	78.2	71.3	0
21-Aug	46	82	69.2	0.61
22-Aug	47	84.8	72.4	0.01
23-Aug	48	78.3	60.5	0
24-Aug	49	84.8	56	0

Date	Days After Planting	Max Temp °F	Min Temp °F	Rainfall (in.)
25-Aug	50	82.6	55.9	0
26-Aug	51	86.8	59.7	0
27-Aug	52	91.1	69.3	0
28-Aug	53	94.8	73.5	0
29-Aug	54	95.5	77.1	0
30-Aug	55	92.1	75.2	0
31-Aug	56	86.9	71.2	0.66
1-Sep	57	83.4	72.5	0.07
2-Sep	58	88.4	73.7	0
3-Sep	59	92.3	71.8	0
4-Sep	60	94.6	71.7	0
5-Sep	61	93.3	72.3	0
6-Sep	62	94.4	74.2	0
7-Sep	63	91.1	72.2	1.08
8-Sep	64	76.6	67.2	1.29
9-Sep	65	70.5	63.4	0.92
10-Sep	66	78.1	63.4	0.17
11-Sep	67	87.8	72	0.07
12-Sep	68	86.7	73.1	0.01
13-Sep	69	79.4	71.8	0.04
14-Sep	70	78.8	71.8	0.62
15-Sep	71	79.7	67.7	0.04
16-Sep	72	80.1	69.6	0
17-Sep	73	82.5	71.8	0.01
18-Sep	74	86.6	71.2	1.26
19-Sep	75	83.4	67.2	0
20-Sep	76	76.8	64.1	0
21-Sep	77	79.8	60.3	0
22-Sep	78	82	64.4	0
23-Sep	79	67.9	63	0.98
24-Sep	80	67.9	63.8	0.31
25-Sep	81	84.4	68	0.02
26-Sep	82	87	71.2	0.02
27-Sep	83	71.2	66.1	0.08
28-Sep	84	76	56.6	0.06
29-Sep	85	77.9	53.5	0.01
30-Sep	86	77.9	55.7	0
1-Oct	87	81.8	58.7	0

Appendix D: Weather Data for 2018 First Year Baby Lima Variety Trial at Georgetown July 6th (planting) to October 1st (final harvest)



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