

**UNIVERSITY OF
DELAWARE**



LIMA BEAN

VARIETY

TRIAL

RESULTS

Emmalea Ernest & Gordon Johnson

**University of Delaware
Research and Education Center
16483 County Seat Highway
Georgetown, DE 19947**

2017

2017 UNIVERSITY OF DELAWARE GREEN BABY LIMA BEAN AND FORDHOOK LIMA BEAN VARIETY TRIALS

Emmalea Ernest & Gordon Johnson
University of Delaware Research and Education Center
16483 County Seat Highway
Georgetown, DE 19947
(302) 856-7303 emmalea@udel.edu gcjohn@udel.edu

2017 Baby Lima Bean Variety Trials

In 2017 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 9, 2017

The Irrigated Baby Lima Bean Variety Trial was planted on June 9 and included a total of 43 lines. Seven of the lines were entered by ADM Seedwest. Thirty-three lines were from the University of Delaware lima bean breeding program. The remaining three 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, 2017

Variety Name	Source	Variety Name	Source
Brooke (DE0407905)	University of Delaware	DE1200309C	University of Delaware
Bert (DE0407907)	University of Delaware	DE1200403A	University of Delaware
DE0505002A	University of Delaware	DE1200404A	University of Delaware
DE0802101A	University of Delaware	DE1201101A	University of Delaware
DE0802101W	University of Delaware	DE1202203A	University of Delaware
DE0802102B	University of Delaware	DE1202205A	University of Delaware
DE0900604B	University of Delaware	DE1202305B	University of Delaware
DE1000701A	University of Delaware	DE1202606A	University of Delaware
DE1000701B	University of Delaware	DE1202802C	University of Delaware
DE1001102E	University of Delaware	DE1202906B	University of Delaware
DE1001104B	University of Delaware	DE1203001B	University of Delaware
DE1001201A	University of Delaware	G200381	ADM
DE1001202B	University of Delaware	G200382	ADM
DE1001202C	University of Delaware	G3024416	ADM
DE1001202E	University of Delaware	G9002034	ADM
DE1001802A	University of Delaware	G9005033	ADM
DE1100402B	University of Delaware	G9005036	ADM
DE1100704A	University of Delaware	G9005042	ADM
DE1100805B	University of Delaware	Meadow	ADM (standard variety)
DE1101207A	University of Delaware	Cypress	ADM (standard variety)
DE1200307B	University of Delaware	C-elite Select	Ben Fish (standard variety)
DE1200309A	University of Delaware		

Location:

Field 27-A at the University of Delaware Research and Education Center Farm, Georgetown, DE

Cultural Practices:

The trial was planted on June 9, 2017 with a Monosem 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. Plots were 25 feet in length. The variety 'Cypress' was planted in every other row as a border between experimental plots. Plots were arranged in a randomized complete block design with four replications. The field was fertilized with potassium (0-0-60) before planting according to soil test results. A pre-emergence application of 1.25 pt/A Dual II Magnum for weed control as well as 49 lbs/A nitrogen in the form of 30% UAN was made on June 10. Plots were cultivated on July 3 and July 14. One sidedress application of 33 lbs/A nitrogen in the form of 30% UAN was made on July 14. Additional hand weeding was done as necessary. Weed control in the trial was excellent. Warrior II at 2 fl oz/A and Tactic at 1 pt/A were applied on August 15 for stinkbugs. Kocide at 1 lb/A was applied on August 22. A small amount of downy mildew (did not decrease yields) was observed in two of the last plots to be harvested.

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 23 (75 DAP) and ended on September 14 (97 DAP).

A 15-foot section from each plot was harvested. The plants were cut off at soil level and weighed. To determine maturity at harvest, pods were stripped from five harvested plants from each plot and counted as full, flat or dry. The plants and pulled pods 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 June 9, 2017**

The Irrigated First Year Trial of Baby Lima Bean Breeding Lines was planted on June 9 and included a total of 37 lines. Thirty-five 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 June 10, 2017

Variety Name	Description	Variety Name	Description
Cypress	commercial standard	DE1305503A	UD Breeding Line
C-elite Select	commercial standard	DE1305601B	UD Breeding Line
DE1304305	UD Breeding Line	DE1305601C	UD Breeding Line
DE1304306	UD Breeding Line	DE1304103	UD Breeding Line
DE1304501	UD Breeding Line	DE1304201	UD Breeding Line
DE1304702B	UD Breeding Line	DE1304304	UD Breeding Line
DE1304703A	UD Breeding Line	DE1304401B	UD Breeding Line
DE1304803A	UD Breeding Line	DE1304401C	UD Breeding Line
DE1307703B	UD Breeding Line	DE1304502	UD Breeding Line
DE1307703C	UD Breeding Line	DE1304503	UD Breeding Line
DE1307903B	UD Breeding Line	DE1307704A	UD Breeding Line
DE1308002A	UD Breeding Line	DE1306602B	UD Breeding Line
DE1308002B	UD Breeding Line	DE1306603A	UD Breeding Line
DE1305203A	UD Breeding Line	DE1306604B	UD Breeding Line
DE1305204A	UD Breeding Line	DE1306604C	UD Breeding Line
DE1305301C	UD Breeding Line	DE1306731	UD Breeding Line
DE1305402B	UD Breeding Line	DE1306925	UD Breeding Line
DE1305403D	UD Breeding Line	DE13070103	UD Breeding Line
DE1305405B	UD Breeding Line		

Location:

Field 27-A at the University of Delaware Research and Education Center Farm, Georgetown, DE

Cultural Practices:

The trial was planted by hand on June 9, 2017. 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 planted in every other row as a border between experimental plots. Plots were arranged in a randomized complete block design with three replications. The field was fertilized with potassium (0-0-60) before planting according to soil test results. A pre-emergence application of 1.25 pt/A Dual II Magnum for weed control as well as 49 lbs/A nitrogen in the form of 30% UAN was made on June 10. Plots were cultivated on July 3 and July 14. One sidedress application of 33 lbs/A nitrogen in the form of 30% UAN was made on July 14. Additional hand weeding was done as necessary. Weed control in the trial was excellent. Warrior II at 2 fl oz/A and Tactic at 1 pt/A were applied on August 15 for stinkbugs. Kocide at 1 lb/A was applied on August 22. No disease was observed in the plot.

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 23 (75 DAP) and ended on September 18 (101 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.

Quality Evaluation of Blanched and Frozen Samples of Baby Lima Lines:

The processing quality of advanced UD breeding material was evaluated by six representatives of the regional processors at a meeting on December 13, 2017. Samples of 68 UD breeding lines, and three standard and one experimental cultivar in the trial (Meadow, Cypress, C-elite Select and G200382) were evaluated. Samples of harvested beans were washed and rotten, sprouted and split beans and plant debris were removed. Light colored beans were not graded out. The cleaned samples were blanched for three minutes in boiling water, and then cooled immediately in ice water. Cooled beans were drained using a salad spinner then packed in Ziploc plastic bags and frozen at -10°F. Five commercially frozen baby lima samples that were purchased at local grocery stores were included in the evaluation as controls. On the day of the evaluation the samples were thawed briefly in warm water, drained in a colander and a one cup sample was displayed in a white Styrofoam bowl. Samples were randomized and identified only by a number. The group of six evaluators was comprised of fieldmen, and processing and preprocessing quality experts from the four regional lima bean processors. Evaluators rated the samples for size, shape, color and overall acceptability.

Results and Discussion of the Baby Lima Trials at Georgetown

Weather, Pod Set and Maturity for the Irrigated Baby Lima Trials

Sustained high nighttime temperatures in July delayed pod set in the baby lima trials. Days to harvest for the three standard varieties, Cypress, C-elite Select and 184-85 were 7 to 9 days longer than the historical averages and similar to DTH for other 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	--

Split sets developed in some varieties, particularly those that matured earlier.

Yield and Maturity in the June 9 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 new 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 high in this trial. The highest yielding entries in the 2017 trial were DE1202305B, DE1200404A, DE1201101A, DE1001802A, DE1001102E, DE1200309C, DE0900604B, DE1202205A, DE1202606A, DE1202203A and DE1101207A. All of these lines produced significantly higher yields than all three of the standard varieties (Cypress, C-elite Select and Meadow) except that DE1101207A was not significantly different than Cypress. Of the top yielding varieties, DE 1201101A and DE1001102E have very high quality green seed and DE1202205A, DE1202606A and DE1202203A were rated acceptable for overall quality and color by most evaluators (Table 5 and Figure 1). DE0802101A matured in 81 days (4 days earlier than Cypress) and was the highest yielding of the early maturing varieties (Table 1 and Figure 1). DE0802101A is a speckled lima type similar to Jackson Wonder.

The performance of UD breeding lines with seed quality traits making them of particular interest for commercial release is as follows:

DE1001102E matured in 95 days and yielded 5664 lbs/A. Its yield was significantly higher than that of all three standard varieties in the trial. It has very high quality green seed and resistance to race F of downy mildew. One disadvantage of this line is its longer time to maturity.

DE1001202C matured in 89 days and yielded 5068 lbs/A. Its yield was numerically higher than all three standard varieties but only significantly higher than that of Meadow. Seed quality for this line was comparable to that of Meadow and C-elite Select. It is resistant to race F of downy mildew and has a narrow, upright plant architecture.

DE1001202E matured in 88 days and yielded 4802 lbs/A. Its yield was numerically but not significantly higher than all three standard varieties. It has very high quality green seed and a narrow upright plant architecture.

DE1100402B matured in 90 days and yielded 4731 lbs/A. Its yield was numerically but not significantly higher than all three standard varieties. It has very high quality green seed and a narrow upright plant architecture.

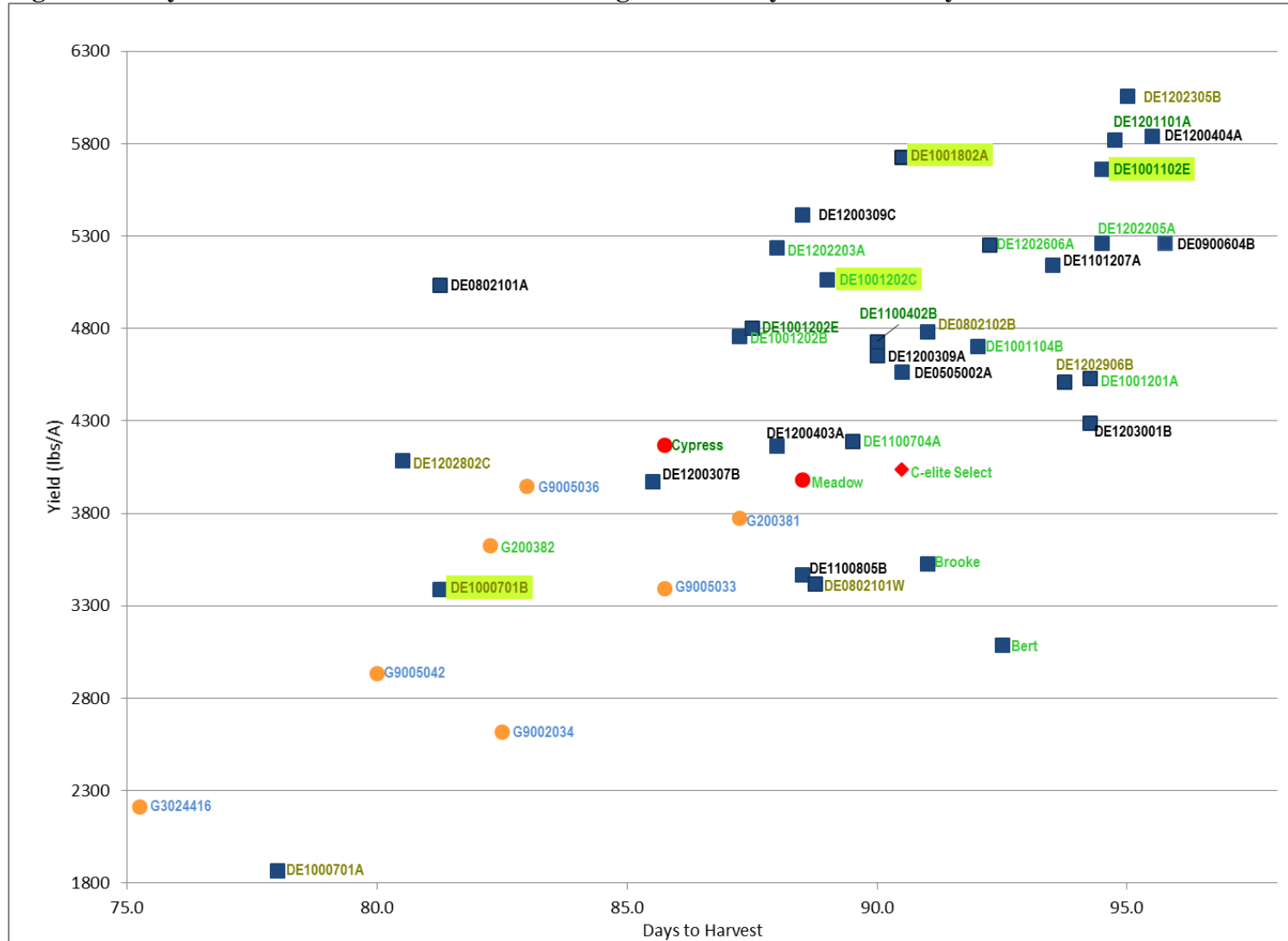
Among the varieties entered by ADM, G9005036 was the highest yielding entry and G3024416 was the earliest maturing. None of the ADM entries had yields that were significantly higher than that of Cypress or Meadow. G200382, which performed well in past years trials yielded 3629 lbs/A and matured in 82 days. Maturity for G200382 was three days earlier than Cypress in this trial.

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 3. 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.

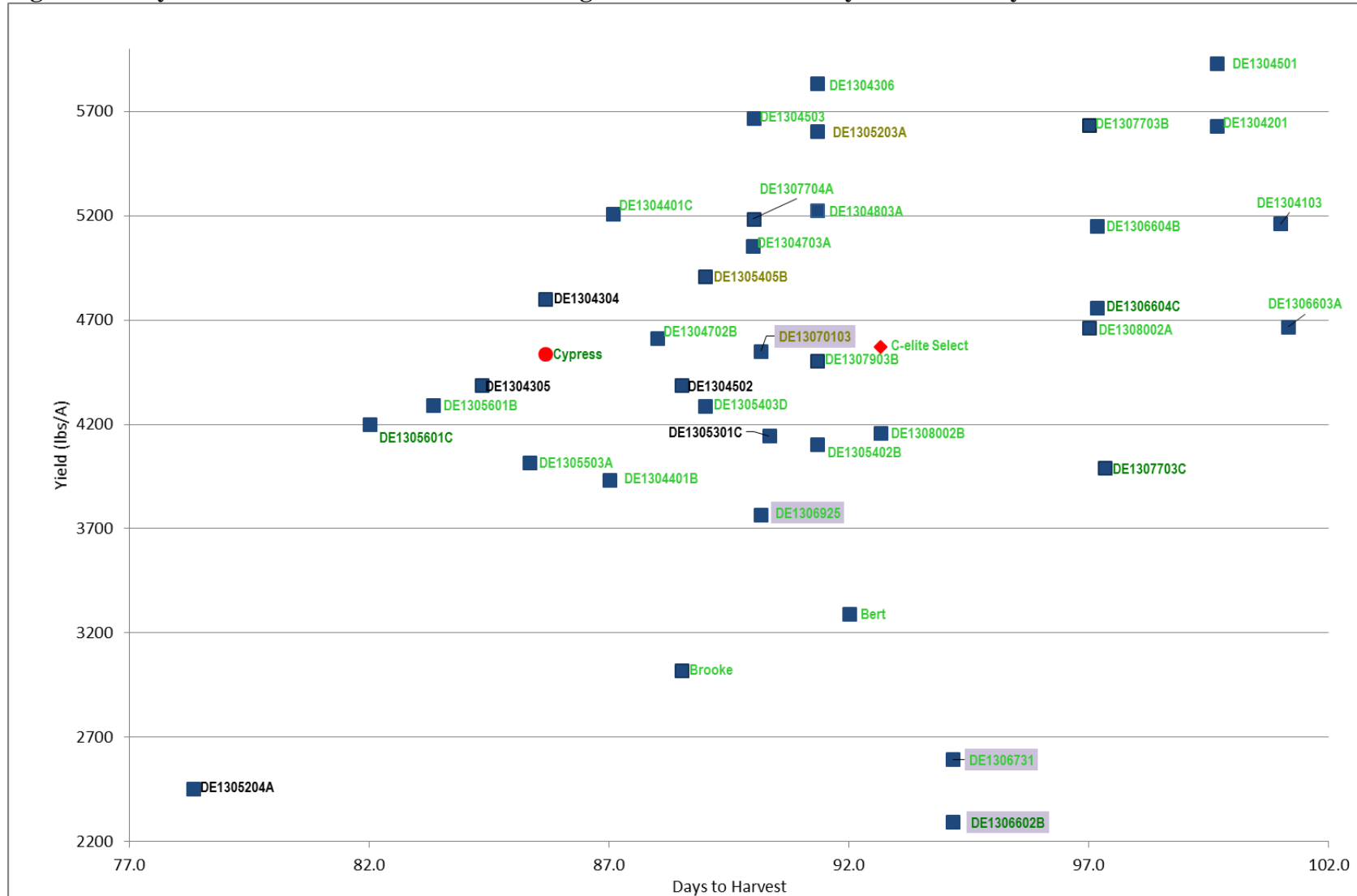
As in the past two years, breeding lines that were being evaluated for the first time were tested in a separate trial, which was not evaluated for maturity by categorizing and counting pods at harvest. The Irrigated First Year Trial was planted on the same day as the irrigated advanced trial. Yields of standard varieties in this trial were comparable to those in the Irrigated Advanced Trial. The results from this trial are in Table 6, Table 7 and Figure 2. This trial included four breeding lines with resistance to root knot nematode. Fourteen of the lines from this trial will be advanced to evaluation in the main irrigated trial in 2018: DE1304304, DE1304306, DE1304401C, DE1304503, DE1304703A, DE1304803A, DE1305203A, DE1305204A, DE1305405B, DE1305601B, DE1305601C, DE1306925, DE13070103, and DE1307704A.

Figure 1. Baby Lima Bean Varieties in the 2017 Irrigated Trial by Yield and Days to Harvest*



* color of data label indicates seed quality rating: **Rated acceptable by all evaluators for color and overall appearance**, **Rated acceptable by most evaluators for color and overall appearance**, **Rated acceptable by most evaluators for overall appearance but rated unacceptable for color**, **Not evaluated**, **Not acceptable as a green baby lima**. **Green highlight**—resistant to race F of downy mildew.

Figure 2. Baby Lima Bean Varieties in the 2017 Irrigated First Year Trial by Yield and Days to Harvest*



* color of data label indicates seed quality rating: **Rated acceptable by all evaluators for color and overall appearance**, **Rated acceptable by most evaluators for color and overall appearance**, **Rated acceptable by most evaluators for overall appearance but rated unacceptable for color**, **Not evaluated**, **Not acceptable as a green baby lima**. **Purple highlight**=root knot nematode resistant.

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 9, 2017

Variety ¹	Days to Harvest	Yield (Lbs/A)	% Full Pods	% Flat Pods	% Dry Pods	# Pods/Plant	% Conversion	% Stand ²
DE1202305B	95.0 a	6058 a	77.2 a-m	8.4 j-o	14.4 b-k	28 a-g	17.7 a-c	82.9 h-m
DE1200404A	95.5 a	5840 ab	74.4 c-n	19.9 b-h	5.8 k	31 a-c	15.2 b-j	80.0 l-o
DE1201101A	94.8 ab	5822 a-c	82.5 a-f	5.1 l-o	12.4 c-k	32 a	17.6 a-c	91.3 a-g
DE1001802A	90.5 c-g	5729 a-d	87.7 a	2.4 o	9.9 d-k	27 a-j	19.2 a	75.8 m-o
DE1001102E	94.5 ab	5664 a-e	79.3 a-i	4.5 m-o	16.2 b-k	25 a-l	16.8 a-f	91.7 a-g
DE1200309C	88.5 f-i	5419 a-f	75.7 b-m	12.4 f-o	11.9 c-k	28 a-f	19.2 a	86.3 c-l
DE0900604B	95.8 a	5263 a-g	70.1 h-q	5.5 l-o	24.4 ab	22 d-n	16.8 a-e	90.8 a-h
DE1202205A	94.5 ab	5263 a-g	82.4 a-f	4.7 l-o	12.9 c-k	24 a-l	14.9 b-j	93.8 a-d
DE1202606A	92.3 a-f	5253 a-g	66.0 m-r	13.3 e-n	20.7 a-d	20 g-n	16.3 a-g	93.8 a-d
DE1202203A	88.0 g-i	5239 a-g	85.1 a-c	3.8 no	11.1 c-k	24 c-m	17.9 ab	90.8 a-h
DE1101207A	93.5 a-d	5143 a-h	77.6 a-l	10.0 h-o	12.4 c-k	29 a-d	16.7 a-f	84.6 e-l
DE1001202C	89.0 e-i	5068 a-i	81.2 a-h	7.1 j-o	11.8 c-k	28 a-g	16.8 a-f	85.8 d-l
DE0802101A	81.3 kl	5037 a-i	75.8 b-m	9.8 h-o	14.4 b-k	22 d-m	17.9 ab	91.2 a-g
DE1001202E	87.5 g-i	4802 b-j	84.4 a-d	7.3 j-o	8.3 f-k	27 a-i	15.7 b-i	91.3 a-g
DE0802102B	91.0 b-g	4783 c-j	78.9 a-j	5.6 k-o	15.5 b-k	24 c-m	16.8 a-f	94.6 ab
DE1001202B	87.3 g-i	4761 d-j	81.7 a-g	6.2 j-o	12.1 c-k	23 d-m	15.6 b-i	91.7 a-g
DE1100402B	90.0 d-g	4731 d-j	86.6 ab	6.9 j-o	6.5 jk	29 a-e	17.4 a-d	74.6 n-p
DE1001104B	92.0 a-f	4708 d-j	73.0 e-n	18.7 b-i	8.3 f-k	16 mn	15.8 b-h	91.7 a-g
DE1200309A	90.0 d-g	4654 e-k	83.0 a-e	9.0 i-o	8.0 f-k	27 a-h	15.6 b-i	94.6 ab
DE0505002A	90.5 c-g	4566 f-k	81.4 a-h	11.1 h-o	7.6 h-k	22 e-n	15.9 b-h	92.5 a-e
DE1001201A	94.3 a-c	4532 f-k	67.9 j-q	12.2 f-o	19.9 b-e	20 g-n	13.9 e-k	94.2 a-c
DE1202906B	93.8 a-d	4515 f-k	70.5 g-q	11.8 g-o	17.7 b-i	19 j-n	14.2 d-j	89.4 a-j
DE1203001B	94.3 a-c	4290 g-m	55.6 r	34.7 a	9.6 d-k	14 n	12.9 h-m	93.8 a-d
DE1100704A	89.5 e-h	4194 h-m	71.2 f-p	11.2 h-o	17.6 b-j	26 a-k	15.4 b-j	81.3 k-o
Cypress	85.8 h-j	4173 h-m	73.2 d-n	14.9 d-l	11.9 c-k	26 a-k	15.1 b-j	81.7 j-o
DE1200403A	88.0 g-i	4165 h-m	76.0 b-m	8.1 j-o	15.9 b-k	32 ab	15.3 b-j	88.8 b-k
DE1202802C	80.5 kl	4087 i-n	70.9 g-q	22.0 b-g	7.1 i-k	19 j-n	16.4 a-g	97.1 a
C-elite Select	90.5 c-g	4037 i-n	71.3 f-p	18.8 b-i	10.0 d-k	21 f-n	13.5 g-l	84.2 f-l
Meadow	88.5 f-i	3984 j-n	68.3 i-q	12.7 f-o	19.0 b-f	22 d-m	14.3 d-j	93.9 a-c
DE1200307B	85.5 ij	3975 j-o	66.4 l-r	15.8 c-k	17.8 b-i	22 d-n	15.5 b-j	92.1 a-f
G9005036	83.0 jk	3944 j-o	72.9 e-n	20.0 b-h	7.1 i-k	20 i-n	15.3 b-j	83.7 g-m
G200381	87.3 g-i	3774 j-o	60.3 p-r	25.2 a-c	14.4 b-k	21 f-n	14.5 c-j	90.4 a-h
G200382	82.3 jk	3629 k-p	67.4 k-q	23.4 b-e	9.2 e-k	24 b-l	13.0 h-m	88.8 b-k
Brooke	91.0 b-g	3530 l-p	72.3 e-o	5.6 k-o	22.0 a-c	18 k-n	12.9 h-m	90.0 a-i
DE1100805B	88.5 f-i	3468 m-p	59.6 qr	9.0 i-o	31.3 a	19 k-n	12.8 h-m	82.1 i-n
DE0802101W	88.8 e-i	3422 m-p	68.2 i-q	12.9 f-n	18.9 b-g	20 i-n	13.7 f-k	92.1 a-f
G9005033	85.8 h-j	3396 m-p	64.1 n-r	24.5 a-d	11.4 c-k	24 b-l	13.8 e-k	85.8 d-l
DE1000701B	81.3 kl	3391 m-p	78.0 a-k	14.3 d-m	7.7 g-k	29 a-e	12.3 j-m	91.3 a-g
Bert	92.5 a-e	3087 n-q	72.0 e-o	9.4 i-o	18.6 b-h	20 h-n	10.4 l-n	91.8 a-f
G9005042	80.0 kl	2934 o-q	69.7 i-q	22.4 b-f	7.9 f-k	22 d-n	12.6 i-m	73.7 op
G9002034	82.5 jk	2620 p-r	61.2 o-r	27.4 ab	11.4 c-k	18 l-n	10.9 k-n	67.1 p
G3024416	75.3 m	2214 qr	60.4 p-r	27.1 a-b	12.5 c-k	19 k-n	10.0 mn	80.0 l-o
DE1000701A	78.0 lm	1867 r	69.3 i-q	16.3 c-j	14.4 b-k	21 f-n	8.5 n	85.4 e-l
<i>p-value</i>	<0.0001	<0.0001	<0.0001	<0.0001	0.0057	<0.0001	<0.0001	<0.0001
Fisher's LSD ³	3.77	1044.0	11.35	10.30	11.19	7.6	3.16	8.04
Tukey's HSD ⁴	7.65	2121.9	23.07	23.94	20.94	15.4	6.43	16.34
C.V. ⁵	3.0	17.2	11.1	55.4	59.5	23.2	15.1	6.6

¹Varieties highlighted and in bold are resistant to race F of downy mildew. 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. ⁴Minimum significant difference according to Tukey's HSD. ⁵Coefficient of Variation.

Table 3. Average Days to Harvest and Standard Deviation of Days to Harvest for the Irrigated Baby Lima Bean Variety Trial Planted June 9, 2017

Variety	Average Days to Harvest	Standard Deviation of Days to Harvest*
DE1200403A	88.0	0.00
DE1202305B	95.0	0.00
G9005036	83.0	0.00
DE1201101A	94.8	0.50
G3024416	75.3	0.50
DE1100805B	88.5	0.58
DE1200309C	88.5	0.58
Meadow	88.5	0.58
DE1001202C	89.0	0.82
DE1200309A	90.0	0.82
DE0505002A	90.5	1.00
DE1001802A	90.5	1.00
DE1200404A	95.5	1.00
C-elite Select	90.5	1.00
DE1100704A	89.5	1.29
DE0802101W	88.8	1.50
DE0900604B	95.8	1.50
G200382	82.3	1.50
DE1101207A	93.5	1.73
DE1000701A	78.0	2.31
Brooke	91.0	2.83
DE0802102B	91.0	2.83
DE1100402B	90.0	2.83
DE1200307B	85.5	2.89
DE1001201A	94.3	2.99
DE1001202B	87.3	2.99
G200381	87.3	2.99
Bert	92.5	3.00
DE1001202E	87.5	3.11
DE1202606A	92.3	3.20
G9005033	85.8	3.20
Cypress	85.8	3.20
DE1202802C	80.5	3.32
DE1202906B	93.8	3.40
DE1001104B	92.0	3.46
DE1202203A	88.0	3.46
DE0802101A	81.3	3.50
DE1000701B	81.3	3.50
DE1001102E	94.5	3.79
DE1202205A	94.5	3.79
DE1203001B	94.3	4.27
G9005042	80.0	5.66
G9002034	82.5	6.35

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 4. Yield and 100 Seed Weight for Varieties in the 2017 Irrigated Baby Lima Trial

Variety	Yield (lbs/A)	Weight of 100 Succulent Seeds (g)
DE0900604B	5263 a-g	89.42 a
DE1202606A	5253 a-g	85.97 ab
DE1203001B	4290 g-m	85.66 a-c
DE1202205A	5263 a-g	85.40 a-c
DE1001201A	4532 f-k	85.08 a-c
DE1001102E	5664 a-e	83.37 a-d
DE1200404A	5840 ab	82.02 b-e
DE1202305B	6058 a	80.53 b-f
DE1001202B	4761 d-j	80.29 b-g
DE1001202E	4802 b-j	80.06 b-g
DE1001104B	4708 d-j	79.93 b-g
DE1202203A	5239 a-g	79.71 c-h
DE1202906B	4515 f-k	79.53 c-i
DE1201101A	5822 a-c	78.34 d-j
DE0505002A	4566 f-k	77.80 d-k
G200381	3774 j-o	77.45 d-l
DE1100402B	4731 d-j	77.42 d-l
Bert	3087 n-q	77.18 e-l
G9005036	3944 j-o	76.68 e-m
DE1001202C	5068 a-i	76.61 e-m
G9002034	2620 p-r	76.32 e-m
DE1001802A	5729 a-d	75.22 f-n
Brooke	3530 l-p	75.02 f-n
DE1000701B	3391 m-p	75.01 f-n
DE0802102B	4783 c-j	74.28 g-o
G200382	3629 k-p	73.70 h-o
DE0802101A	5037 a-i	73.46 i-o
DE0802101W	3422 m-p	73.40 i-o
Cypress	4173 h-m	72.90 j-o
DE1101207A	5143 a-h	72.58 j-o
Meadow	3984 j-n	72.22 j-o
G9005042	2934 o-q	71.75 k-p
G3024416	2214 qr	71.35 l-p
C-elite Select	4037 i-n	70.92 m-p
DE1100805B	3468 m-p	70.81 m-p
DE1202802C	4087 i-n	69.34 n-q
DE1200309C	5419 a-f	69.34 n-q
DE1100704A	4194 h-m	69.29 n-q
G9005033	3396 m-p	68.86 o-q
DE1000701A	1867 r	65.94 p-r
DE1200309A	4654 e-k	65.81 p-r
DE1200403A	4165 h-m	63.33 qr
DE1200307B	3975 j-o	61.59 r
<i>p-value</i>	<0.0001	<0.0001
Fishers' LSD¹	1044.0	6.1414
Tukey's HSD²	2121.9	12.482
C.V.³	17.2	5.805241

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

²Minimum significant difference according to Tukey's HSD.

³Coefficient of Variation.

Table 5. Yield and Results of Succulent Seed Quality Evaluation for Varieties in the 2017 Irrigated Baby Lima Trial

Variety	Yield	% Rating Color Acceptable	% Rating Overall Acceptable	
DE1201101A	5822 a-c	100	100	Rated acceptable by all evaluators for color and overall appearance
DE1001102E	5664 a-e	100	100	
DE1001202E	4802 b-j	100	100	
DE1100402B	4731 d-j	100	100	
Cypress	4173 h-m	100	100	
Control A	--	100	100	
Meadow	3984 j-n	83	100	Rated acceptable by most evaluators for color and overall appearance
DE1202205A	5263 a-g	83	83	
DE1202203A	5239 a-g	83	83	
DE1001202C	5068 a-i	83	83	
DE1001104B	4708 d-j	83	83	
DE1100704A	4194 h-m	83	83	
G200382	3629 k-p	83	83	
DE1202606A	5253 a-g	67	83	
DE1001202B	4761 d-j	67	83	
DE1001201A	4532 f-k	67	83	
C-elite Select	4037 i-n	67	83	
Brooke	3530 l-p	67	83	
Control B	--	67	83	
Bert	3087 n-q	67	67	
DE0802101W	3422 m-p	50	83	Rated acceptable by most evaluators for overall appearance but rated unacceptable for color
DE1000701A	1867 r	50	83	
Control C	--	50	83	
DE1001802A	5729 a-d	33	83	
Control D	--	33	83	
DE1202305B	6058 a	17	83	
DE0802102B	4783 c-j	50	67	
DE1202906B	4515 f-k	33	67	
DE1000701B	3391 m-p	33	67	
DE1202802C	4087 i-n	17	67	Rated unacceptable as a green baby lima
DE1100805B	3468 m-p	67	50	
DE1200403A	4165 h-m	33	33	
Control E	--	33	33	
DE1200309C	5419 a-f	17	33	
DE0505002A	4566 f-k	0	33	
DE1200309A	4654 e-k	0	17	
DE1200404A	5840 ab	0	0	
DE0900604B	5263 a-g	0	0	
DE1101207A	5143 a-h	0	0	
DE0802101A	5037 a-i	0	0	
DE1203001B	4290 g-m	0	0	
DE1200307B	3975 j-o	0	0	

Table 6. Days to Harvest, Yield, Plant Weight, Percent Stand, Seed Weight and Seed Color for the Irrigated First Year Trial of Baby Lima Bean Breeding Lines Planted June 9, 2017

Variety	Days to Harvest ¹	Yield (Lbs/A) ¹	Plant Weight (Lbs/15 ft) ¹	% Conversion	% Stand ^{1,2}	Weight of 100 Succulent Seeds (g) ¹
DE1304501	99.7 a	5931 a	23.9 a	14.2 b-g	98.3 ab	74.8 c-h
DE1304306	91.3 bc	5836 a	18.3 d-h	18.3 a	94.2 a-d	69.2 e-i
DE1304503	90.0 **	5669 **	17.0 **	19.3 **	86.3 **	73.5 **
DE1307703B	97.0 a	5634 ab	23.0 ab	14.1 b-g	91.7 a-d	88.6 a
DE1304201	99.7 a	5631 ab	22.4 a-c	14.4 b-g	96.7 a-c	85.0 a-c
DE1305203A	91.3 bc	5603 ab	19.8 c-f	16.3 ab	99.2 ab	54.1 k
DE1304803A	91.3 bc	5224 abc	19.6 c-g	15.2 b-e	85.0 d	66.0 g-i
DE1304401C	87.1 **	5208 **	18.8 **	15.9 **	95.0 **	81.6 **
DE1307704A	90.0 **	5185 **	22.1 **	13.7 **	98.8 **	80.9 **
DE1304103	101.0 a	5163 a-d	20.7 b-d	14.3 b-g	95.8 a-c	83.8 a-d
DE1306604B	97.2 *	5151 *	25.9 *	11.5 *	97.5 *	73.2 *
DE1304703A	90.0 bc	5055 a-e	18.8 d-h	15.5 b-d	95.0 a-c	74.1 d-i
DE1305405B	89.0 bcd	4909 a-e	19.7 c-g	14.2 b-g	100.8 a	79.6 a-e
DE1304304	85.7 def	4799 a-e	17.2 f-h	16.2 ab	95.8 a-c	79.4 a-e
DE1306604C	97.2 *	4759 *	21.6 *	12.8 *	87.5 *	79.1 *
DE1306603A	101.2 *	4667 *	19.7 *	13.7 *	95.0 *	84.1 *
DE1308002A	97.0 a	4663 b-e	22.5 a-c	11.9 f-g	100.8 a	78.0 a-f
DE1304702B	88.0 cde	4612 b-e	16.9 g-h	15.8 a-c	100.0 ab	77.0 b-g
C-elite Select	92.7 b	4571 b-e	17.8 e-h	14.5 b-f	74.2 e	68.0 f-i
DE13070103	90.2 *	4552 *	18.0 *	14.7 *	97.5 *	71.3 *
Cypress	85.7 def	4538 b-e	19.3 d-g	13.4 c-g	95.0 a-c	78.9 a-f
DE1307903B	91.3 bc	4505 b-e	20.2 b-e	12.9 d-g	99.2 ab	71.6 e-i
DE1304305	84.3 ef	4387 cde	17.0 f-h	14.7 b-e	88.3 cd	75.7 b-h
DE1304502	88.5 **	4386 **	18.6 **	13.7 **	87.5 **	79.0 **
DE1305601B	83.3 f	4292 cde	17.9 d-h	13.2 c-g	91.7 a-d	73.5 d-i
DE1305403D	89.0 bcd	4290 cde	19.7 c-g	12.5 e-g	95.8 a-c	73.0 d-i
DE1305601C	82.0 fg	4200 cde	16.4 h	14.7 b-e	96.7 a-c	74.7 c-h
DE1308002B	92.7 b	4159 cde	20.5 b-e	11.7 g	95.8 a-c	66.7 g-i
DE1305301C	90.3 bc	4146 cde	18.4 d-h	13.0 d-g	95.8 a-c	63.4 i-k
DE1305402B	91.3 bc	4103 cde	17.7 e-h	13.3 c-g	90.8 b-d	62.5 jk
DE1305503A	85.3 def	4018 de	18.2 d-h	12.7 e-g	85.0 d	65.1 h-k
DE1307703C	97.3 a	3990 e	22.2 **	10.8 **	96.3 **	86.8 ab
DE1304401B	87.0 **	3933 **	16.1 **	14.2 **	100.0 **	82.0 **
DE1306925	90.2 *	3768 *	15.0 *	14.6 *	60.0 *	67.9 *
Bert	92.0 **	3291 **	15.7 **	12.2 **	77.5 **	67.6 **
Brooke	88.5 **	3019 **	13.6 **	12.8 **	75.0 **	73.9 **
DE1306731	94.2 *	2593 *	13.6 *	11.2 *	90.0 *	62.0 *
DE1305204A	78.3 g	2453 f	17.0 f-h	8.3 h	98.3 ab	62.4 jk
DE1306602B	94.2 *	2293 *	16.1 *	8.3 *	75.0 *	61.8 *
<i>p-value</i>	<i><0.0001</i>	<i>0.0002</i>	<i><0.0001</i>	<i><0.0001</i>	<i>0.0001</i>	<i><0.0001</i>
Fisher's LSD³	4.12	1168.1	2.90	2.77	9.29	11.24
Tukey's HSD⁴	7.95	2253.0	5.56	5.31	17.83	21.68
C.V.⁵	2.77	15.24	9.14	12.05	6.00	9.34

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.

⁴Minimum significant difference according to Tukey's HSD.

⁵Coefficient of Variation.

Table 7. Yield and Results of Succulent Seed Quality Evaluation for Varieties in the 2017 First Year Baby Lima Trial

Variety	Yield	% Rating Color Acceptable	% Rating Overall Acceptable	
DE1306604C	4759 *	100	100	Rated acceptable by all evaluators for color and overall appearance
Cypress	4538 b-e	100	100	
DE1305601C	4200 cde	100	100	
DE1307703C	3990 e	100	100	
DE1306602B	2293 *	100	100	
Control A	--	100	100	
DE1307903B	4505 b-e	83	100	Rated acceptable by most evaluators for color and overall appearance
DE1308002B	4159 cde	100	83	
DE1304501	5931 a	67	83	
DE1307703B	5634 ab	67	83	
DE1304201	5631 ab	83	83	
DE1304803A	5224 abc	67	83	
DE1304401C	5208 **	67	83	
DE1307704A	5185 **	83	83	
DE1304103	5163 a-d	83	83	
DE1306604B	5151 *	67	83	
DE1304703A	5055 a-e	83	83	
DE1306603A	4667 *	83	83	
DE1308002A	4663 b-e	83	83	
DE1304702B	4612 b-e	67	83	
C-elite Select	4571 b-e	67	83	
DE1305601B	4292 cde	83	83	
DE1305403D	4290 cde	67	83	
DE1305402B	4103 cde	83	83	
DE1305503A	4018 de	67	83	
DE1304401B	3933 **	67	83	
D	3019 **	67	83	
Control B	--	67	83	
DE1306731	2593 *	100	67	
DE1304306	5836 a	67	67	
DE1304503	5669 **	67	67	
DE1306925	3768 *	67	67	
Bert	3291 **	67	67	
DE13070103	4552 *	50	83	Rated acceptable for overall appearance but rated unacceptable for color
Control C	--	50	83	
DE1305405B	4909 a-e	33	83	
Control D	--	33	83	
DE1305203A	5603 ab	33	67	
DE1304304	4799 a-e	50	50	Rated unacceptable as a green baby lima
Control E	--	33	33	
DE1304305	4387 cde	0	17	
DE1304502	4386 **	0	17	
DE1305301C	4146 cde	0	17	
DE1305204A	2453 f	0	0	

Appendix A: Weather Data for 2017 Baby Lima Variety Trials at Georgetown

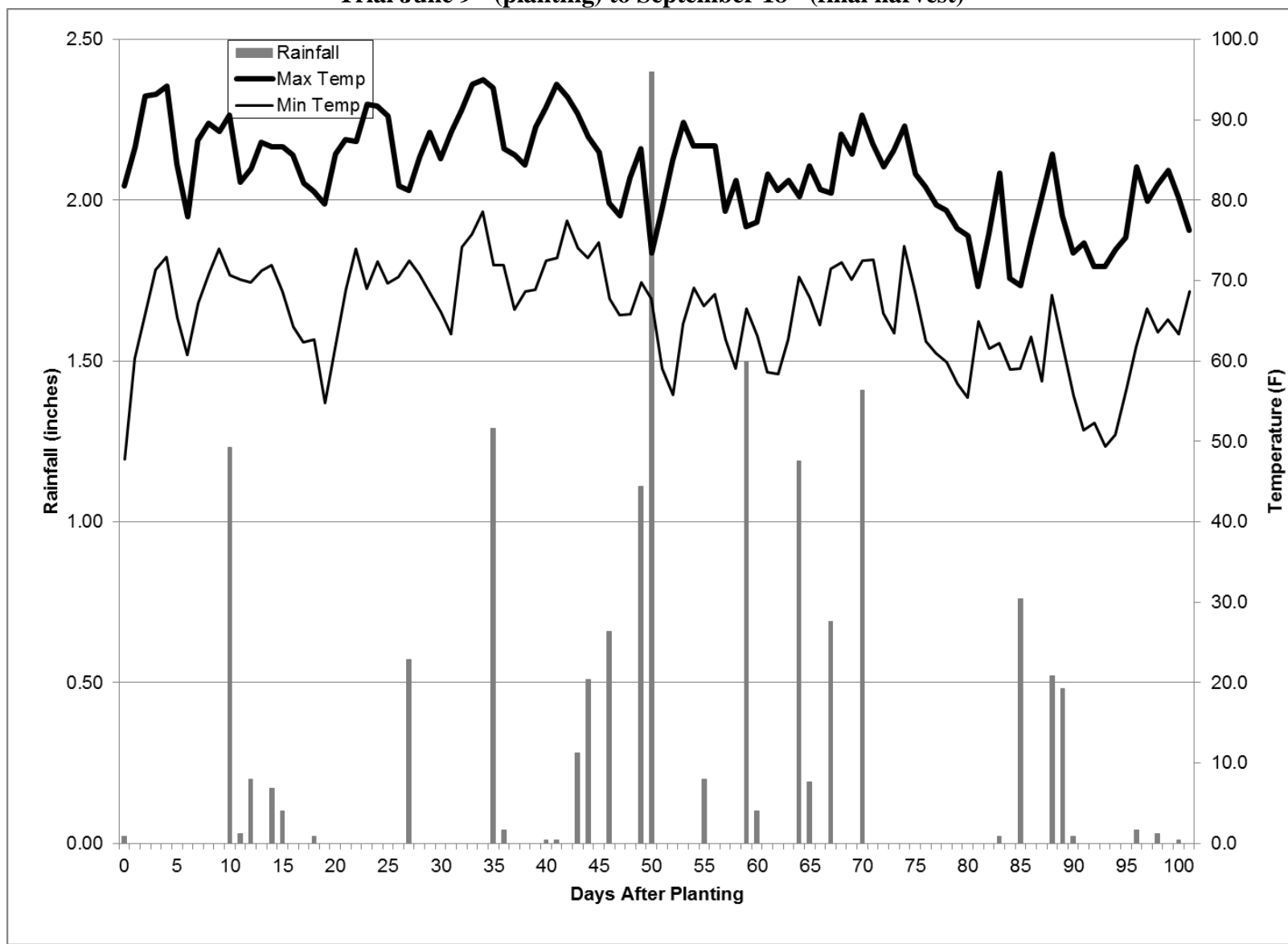
June 9th (planting) to September 18th (final harvest)

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

Date	Days After Planting	Max Temp °F	Min Temp °F	Rainfall (in.)
9-Jun	0	81.8	47.8	0.02
10-Jun	1	86.6	60.3	0
11-Jun	2	92.9	66.0	0
12-Jun	3	93.2	71.3	0
13-Jun	4	94.2	72.9	0
14-Jun	5	84.5	65.4	0
15-Jun	6	77.9	60.8	0
16-Jun	7	87.4	67.2	0
17-Jun	8	89.6	70.9	0
18-Jun	9	88.6	73.9	0
19-Jun	10	90.6	70.7	1.23
20-Jun	11	82.2	70.1	0.03
21-Jun	12	83.9	69.8	0.2
22-Jun	13	87.2	71.2	0
23-Jun	14	86.6	71.9	0.17
24-Jun	15	86.6	68.7	0.1
25-Jun	16	85.6	64.3	0
26-Jun	17	82.1	62.3	0
27-Jun	18	81.1	62.7	0.02
28-Jun	19	79.5	54.8	0
29-Jun	20	85.7	61.5	0
30-Jun	21	87.5	68.9	0
1-Jul	22	87.3	74.0	0
2-Jul	23	91.9	69.0	0
3-Jul	24	91.7	72.4	0
4-Jul	25	90.5	69.7	0
5-Jul	26	81.8	70.4	0
6-Jul	27	81.2	72.5	0.57
7-Jul	28	85.4	70.8	0
8-Jul	29	88.4	68.4	0
9-Jul	30	85.2	66.0	0
10-Jul	31	88.6	63.4	0
11-Jul	32	91.2	74.2	0
12-Jul	33	94.4	75.8	0
13-Jul	34	95.0	78.6	0
14-Jul	35	94.0	71.9	1.29
15-Jul	36	86.4	71.9	0.04
16-Jul	37	85.6	66.4	0
17-Jul	38	84.4	68.6	0
18-Jul	39	89.1	68.9	0
19-Jul	40	91.5	72.5	0.01
20-Jul	41	94.4	72.8	0.01
21-Jul	42	92.8	77.5	0
22-Jul	43	90.8	74.1	0.28
23-Jul	44	87.9	72.8	0.51
24-Jul	45	86.0	74.7	0
25-Jul	46	79.6	67.8	0.66
26-Jul	47	78.1	65.7	0
27-Jul	48	82.8	65.8	0
28-Jul	49	86.4	69.8	1.11
29-Jul	50	73.4	67.7	2.4

Date	Days After Planting	Max Temp °F	Min Temp °F	Rainfall (in.)
30-Jul	51	78.7	59.1	0
31-Jul	52	85.0	55.8	0
1-Aug	53	89.7	64.6	0
2-Aug	54	86.8	69.1	0
3-Aug	55	86.8	66.8	0.2
4-Aug	56	86.7	68.3	0
5-Aug	57	78.6	62.7	0
6-Aug	58	82.5	59.1	0
7-Aug	59	76.7	66.5	1.5
8-Aug	60	77.3	63.1	0.1
9-Aug	61	83.3	58.6	0
10-Aug	62	81.2	58.4	0
11-Aug	63	82.5	62.7	0
12-Aug	64	80.4	70.4	1.19
13-Aug	65	84.3	67.9	0.19
14-Aug	66	81.3	64.5	0
15-Aug	67	80.9	71.5	0.69
16-Aug	68	88.2	72.3	0
17-Aug	69	85.7	70.1	0
18-Aug	70	90.6	72.5	1.41
19-Aug	71	87.0	72.6	0
20-Aug	72	84.2	65.9	0
21-Aug	73	86.2	63.5	0
22-Aug	74	89.2	74.3	0
23-Aug	75	83.2	68.7	0
24-Aug	76	81.7	62.5	0
25-Aug	77	79.4	61.0	0
26-Aug	78	78.7	59.8	0
27-Aug	79	76.5	57.1	0
28-Aug	80	75.6	55.4	0
29-Aug	81	69.3	64.9	0
30-Aug	82	75.8	61.5	0
31-Aug	83	83.4	62.2	0.02
1-Sep	84	70.3	59.0	0
2-Sep	85	69.4	59.1	0.76
3-Sep	86	75.3	63.0	0
4-Sep	87	80.2	57.5	0
5-Sep	88	85.7	68.2	0.52
6-Sep	89	78.1	61.9	0.48
7-Sep	90	73.4	55.7	0.02
8-Sep	91	74.7	51.4	0
9-Sep	92	71.7	52.3	0
10-Sep	93	71.7	49.4	0
11-Sep	94	73.9	50.8	0
12-Sep	95	75.4	56.4	0
13-Sep	96	84.2	61.8	0.04
14-Sep	97	79.9	66.5	0
15-Sep	98	81.9	63.6	0.03
16-Sep	99	83.7	65.2	0
17-Sep	100	80.4	63.4	0.01
18-Sep	101	76.3	68.6	0

Appendix B: Weather Conditions During the 2017 Irrigated Advanced Baby Lima Variety Trial and First Year Baby Lima Trial June 9th (planting) to September 18th (final harvest)



2017 Fordhook Lima Bean Variety Trial

The 2017 Fordhook Lima Bean Variety Trial included a total of 27 lines. Twenty-six 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	DE1102202A	UD Breeding Line
DE0600602B	UD Breeding Line	DE1102209B	UD Breeding Line
DE0600605C	UD Breeding Line	DE1202301B	UD Breeding Line
DE0700904	UD Breeding Line	DE1203402B	UD Breeding Line
DE0701301A	UD Breeding Line	DE1203502A	UD Breeding Line
DE0803801A	UD Breeding Line	DE1203502B I	UD Breeding Line
DE0804404A	UD Breeding Line	DE1203502B II	UD Breeding Line
DE0804404C	UD Breeding Line	DE1307404	UD Breeding Line
DE1002701A	UD Breeding Line	DE1307504C	UD Breeding Line
DE1002703A	UD Breeding Line	DE1307506	UD Breeding Line
DE1002703B	UD Breeding Line	DE1307507	UD Breeding Line
DE1102103C	UD Breeding Line	DE1307601C	UD Breeding Line
DE1102104B	UD Breeding Line	DE1307609	UD Breeding Line
DE1102201A	UD Breeding Line		

Location:

Field 25-B at the University of Delaware Research and Education Center Farm, Georgetown, DE

Cultural Practices:

The trial was hand planted on June 26, 2017 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.

The field was fertilized with potassium according to soil test recommendations before planting. A pre-emergence application of 1.25 pt/A Dual II Magnum as well as 49 lbs/A nitrogen in the form of 30% UAN was made on June 28. Plots were cultivated and sidedressed with 33 lbs/A nitrogen in the form of 30% UAN on July 14. Additional hand weeding was done as necessary. Weed control in the trial was good. Warrior II at 2 fl oz/A and Tactic at 1 pt/A were applied on August 15 for stinkbugs. Kocide at 1 lb/A was applied on August 22 and September 8. Bacterial brown spot was observed in the plot but caused minimal yield loss.

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 (87 DAP) and ended on October 2 (98 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.

Quality Evaluation of Blanched and Frozen Samples of Fordhook Lima Lines:

The processing quality of advanced UD breeding material was evaluated by six representatives of the regional processors at a meeting on December 13, 2017. Samples of 26 UD breeding lines, and the standard variety Fordhook 242 were evaluated. Samples of harvested beans were washed and rotten, sprouted and split beans and plant debris were removed. Light colored beans were not graded out. The cleaned samples were blanched for three minutes in boiling water, and then cooled immediately in ice water. Cooled beans were drained using a salad spinner then packed in Ziploc plastic bags and frozen at -10°F. Two commercially frozen Fordhook lima samples that were purchased at local grocery stores were included in the evaluation as controls. On the day of the evaluation the samples were thawed briefly in warm water, drained in a colander and a one cup sample was displayed in a white Styrofoam bowl. Samples were randomized and identified only by a number. The group of six evaluators was comprised of fieldmen, and processing and preprocessing quality experts from the four regional lima bean processors. Evaluators rated the samples for size, shape, color and overall acceptability.

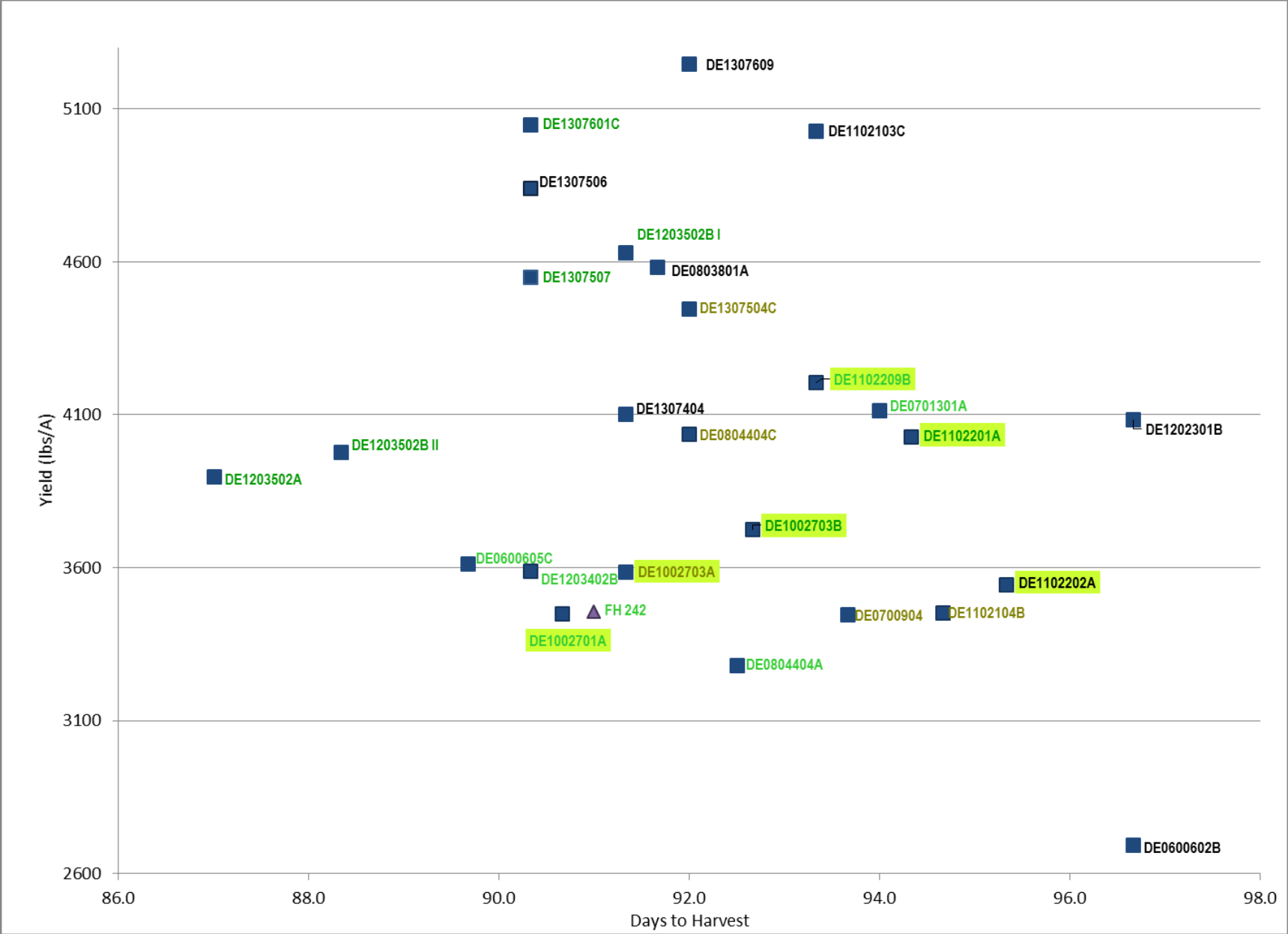
Results and Discussion

This trial was planted in late June and experienced minimal heat stress during flowering which resulted in quicker maturity and higher yields than in some years. Plants were affected by bacterial brown spot after periods of wet and windy weather during pod set, but dryer conditions as the pods matured and application of copper fungicide kept the disease from becoming yield limiting. Overall, yields in this trial were high and there were no statistically significant differences between varieties in terms of yield. Fordhook 242 yielded 3457 lbs/A in this trial.

UD lines of particular interest because of yield and/or quality characteristics are as follows:

DE1102209B, **DE1102201A** and **DE1002703B** have good quality green seed and are resistant to race F of downy mildew. **DE1307601C** and **DE1203502B I** have high yields and good quality green seed. **DE1203502B II** and **DE1203502A** have good quality green seed and earlier maturity.

Figure 3. Fordhook Lima Bean Varieties in the 2017 Trial by Yield and Days to Harvest*



* color of data label indicates seed quality rating: **Rated acceptable by all evaluators for color, size and overall appearance, Rated acceptable by all evaluators for overall appearance and acceptable for color and size by most, Rated acceptable by most evaluators for overall appearance, Not acceptable as a green Fordhook.** **Green highlight**=resistant to race F of downy mildew..

Table 8. Days to Harvest, Yield, Maturity at Harvest, Number of Pods per Plant, Plant Weight, Percent Conversion, Percent Stand at Harvest and Weight of 100 Succulent Seeds for Entries in the 2017 Fordhook Lima Bean Variety Trial

Variety ¹	Days to Harvest	Yield (Lbs/A)	% Full Pods	% Flat Pods	% Dry Pods	# Pods/Plant	Plant Wt (lbs/plot)	% Conversion	% Stand	100 Seed Wt (g)
DE1307609	92.0 b-g	5247 a	72.7 a	6.3 def	21.0 bc	15.0 a	5.9 a	23.0 ab	88.3 a	189 c-g
DE1307601C	90.3 f-i	5048 a	84.8 a	4.9 f	10.3 c-h	16.0 a	5.5 a	23.9 a	85.0 a	182 efg
DE1102103C	93.3 a-f	5029 a	72.4 a	11.4 b-f	16.2 b-g	16.5 a	6.3 a	20.7 a-f	80.0 a	213 bc
DE1307506	90.3 f-i	4840 a	85.3 a	6.5 def	8.1 d-h	19.2 a	5.8 a	21.8 abc	76.7 a	195 c-g
DE1203502B I	91.3 d-h	4630 a	71.1 a	11.2 b-f	17.8 b-e	16.7 a	5.5 a	22.4 abc	80.0 a	182 efg
DE0803801A	91.7 c-h	4584 a	71.2 a	12.7 b-f	16.2 b-g	14.9 a	5.8 a	20.2 a-g	91.7 a	188 c-g
DE1307507	90.3 f-i	4551 a	80.0 a	8.3 c-f	11.7 b-h	17.3 a	6.0 a	19.2 a-h	81.7 a	194 c-g
DE1307504C	92.0 b-g	4446 a	73.4 a	17.5 bcd	9.1 d-h	17.8 a	5.8 a	19.5 a-h	76.7 a	181 fg
DE1102209B	93.3 a-f	4205 a	77.0 a	13.6 b-f	9.4 d-h	16.5 a	6.2 a	17.8 c-h	78.3 a	211 b-e
DE0701301A	94.0 a-d	4113 a	66.9 a	10.9 b-f	22.2 b	11.9 a	5.6 a	19.1 b-h	86.7 a	234 ab
DE1307404	91.3 d-h	4102 a	57.4 a	8.3 c-f	34.4 a	11.5 a	5.5 a	19.8 a-h	91.7 a	188 c-g
DE1202301B	96.7 a	4085 a	62.2 a	31.7 a	6.2 fgh	10.8 a	6.2 a	17.9 c-h	95.0 a	195 c-g
DE0804404C	92.0 b-g	4036 a	75.3 a	10.7 b-f	13.9 b-h	11.9 a	4.7 a	23.3 ab	88.3 a	168 g
DE1102201A	94.3 a-d	4028 a	74.2 a	14.7 b-f	11.1 b-h	13.9 a	6.0 a	17.9 c-h	80.0 a	227 ab
DE1203502B II	88.3 hi	3980 a	73.4 a	11.7 b-f	14.9 b-h	12.2 a	5.0 a	21.1 a-e	83.3 a	187 c-g
DE1203502A	87.0 i	3898 a	82.1 a	12.5 b-f	5.4 gh	14.8 a	5.1 a	20.7 a-e	73.3 a	213 bcd
DE1002703B	92.7 b-g	3726 a	75.2 a	12.1 b-f	12.7 b-h	15.9 a	4.4 a	23.6 ab	61.7 a	184 d-g
DE0600605C	89.7 ghi	3613 a	82.2 a	5.7 ef	12.1 b-h	12.6 a	4.4 a	23.4 ab	71.7 a	207 b-f
DE1203402B	90.3 f-i	3590 a	70.4 a	22.2 ab	7.4 e-h	13.1 a	5.7 a	16.6 d-h	78.3 a	181 fg
DE1002703A	91.3 d-h	3588 a	69.7 a	13.3 b-f	17.0 b-f	14.1 a	4.7 a	21.4 a-d	76.7 a	174 g
DE1102202A	95.3 ab	3547 a	70.9 a	17.1 b-e	12.0 b-h	14.1 a	6.1 a	15.2 h	76.7 a	197 c-g
FH 242	91.0 d-h	3457 a	77.0 a	18.9 bc	4.2 h	15.1 a	5.9 a	15.3 h	66.7 a	178 fg
DE1102104B	94.7 abc	3455 a	66.9 a	19.2 bc	13.8 b-h	10.4 a	5.8 a	15.5 g-h	93.3 a	231 ab
DE1002701A	90.7 e-h	3449 a	67.6 a	13.6 b-f	18.8 bcd	11.2 a	4.7 a	21.2 a-e	80.0 a	187 c-g
DE0700904	93.7 a-f	3447 a	71.8 a	22.1 ab	6.1 fgh	15.7 a	5.9 a	15.9 f-h	85.0 a	193 c-g
DE0804404A	92.5 *	3280 *	75.9 *	13.2 *	10.9 *	10.7 *	5.1 *	17.2 *	90.0 *	179 *
DE0600602B	96.7 a	2694 a	65.0 a	21.7 ab	13.2 b-h	10.2 a	4.6 a	16.5 e-h	80.0 a	246 a
<i>p-value</i>	<0.0001	0.0838	0.0643	0.0062	0.00015	0.078	0.6225	0.0012	0.0631	<0.0001
Fisher's LSD²	3.46	NA	NA	11.59	11.14	NA	NA	4.79	NA	29.54
Tukey's HSD³	6.69	NA	NA	22.46	21.58	NA	NA	9.27	NA	57.25
C.V.⁴	2.29	20.78	12.31	51.23	51.13	23.77	20.29	14.81	13.15	9.14

21

¹Varieties highlighted and in bold are resistant to race F of downy mildew. ²Means followed by the same letter are not significantly different according to Fisher's LSD.

*indicates average of 2 reps. ³Minimum significant difference according to Tukey's HSD. ⁴Coefficient of Variation

Table 9. Yield and Results of Succulent Seed Quality Evaluation for Varieties in the 2017 Fordhook Lima Trial

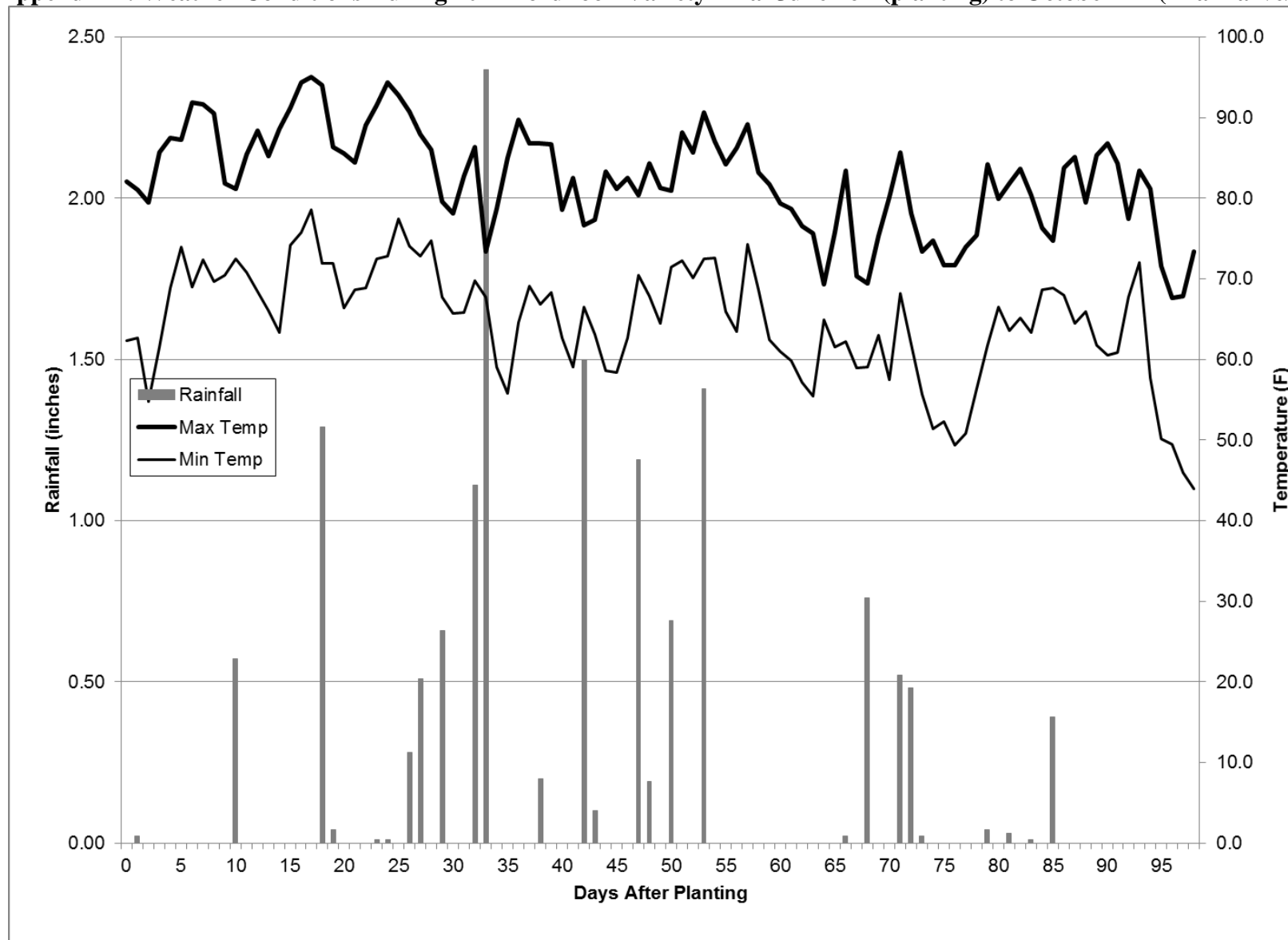
Variety	Yield	Percent of Evaluators Rating:					
		Acceptable Overall Appearance	Acceptable Color	Acceptable Shape	Acceptable Size	Too Big	Too Small
DE1307601C	5048	100	100	100	100	0	0
DE1203502B I	4630	100	100	100	100	0	0
DE1307507	4551	100	100	100	100	0	0
DE1203502B II	3980	100	100	100	100	0	0
DE1102201A	4028	100	100	83	100	0	0
DE1203502A	3898	100	100	83	100	0	0
DE1002703B	3726	100	100	83	100	0	0
DE1002701A	3449	100	100	100	83	0	17
DE0600605C	3613	100	100	67	83	17	0
DE0804404A	3280	100	100	83	50	0	50
DE1102209B	4205	100	83	100	100	0	0
FH 242	3457	100	83	100	100	0	0
DE1203402B	3590	100	83	83	100	0	0
DE0701301A	4113	100	83	67	100	0	0
DE1002703A	3588	83	100	83	83	0	17
DE0804404C	4036	83	83	100	100	0	0
DE1307504C	4446	83	83	83	67	0	33
DE0700904	3447	67	67	50	83	0	0
DE1102104B	3455	67	33	100	67	33	0
Control F		50	17	100	83	0	17
DE1307506	4840	50	17	67	83	0	17
DE1202301B	4085	50	17	67	33	0	67
DE1102202A	3547	50	0	100	100	0	0
Control G		33	33	50	83	17	0
DE0803801A	4584	33	17	83	83	17	0
DE1102103C	5029	33	0	100	100	0	0
DE1307609	5247	17	17	67	100	0	0
DE0600602B	2694	17	0	100	83	0	17
DE1307404	4102	0	0	67	67	0	0

**Appendix E: Weather Data for 2017 Fordhook Lima Variety Trial
June 26th (planting) to October 2nd (final harvest)**

Date	DAP	Max Temp °F	Min Temp °F	Rainfall (in.)
26-Jun	0	82.1	62.3	0
27-Jun	1	81.1	62.7	0.02
28-Jun	2	79.5	54.8	0
29-Jun	3	85.7	61.5	0
30-Jun	4	87.5	68.9	0
1-Jul	5	87.3	74.0	0
2-Jul	6	91.9	69.0	0
3-Jul	7	91.7	72.4	0
4-Jul	8	90.5	69.7	0
5-Jul	9	81.8	70.4	0
6-Jul	10	81.2	72.5	0.57
7-Jul	11	85.4	70.8	0
8-Jul	12	88.4	68.4	0
9-Jul	13	85.2	66.0	0
10-Jul	14	88.6	63.4	0
11-Jul	15	91.2	74.2	0
12-Jul	16	94.4	75.8	0
13-Jul	17	95.0	78.6	0
14-Jul	18	94.0	71.9	1.29
15-Jul	19	86.4	71.9	0.04
16-Jul	20	85.6	66.4	0
17-Jul	21	84.4	68.6	0
18-Jul	22	89.1	68.9	0
19-Jul	23	91.5	72.5	0.01
20-Jul	24	94.4	72.8	0.01
21-Jul	25	92.8	77.5	0
22-Jul	26	90.8	74.1	0.28
23-Jul	27	87.9	72.8	0.51
24-Jul	28	86.0	74.7	0
25-Jul	29	79.6	67.8	0.66
26-Jul	30	78.1	65.7	0
27-Jul	31	82.8	65.8	0
28-Jul	32	86.4	69.8	1.11
29-Jul	33	73.4	67.7	2.4
30-Jul	34	78.7	59.1	0
31-Jul	35	85.0	55.8	0
1-Aug	36	89.7	64.6	0
2-Aug	37	86.8	69.1	0
3-Aug	38	86.8	66.8	0.2
4-Aug	39	86.7	68.3	0
5-Aug	40	78.6	62.7	0
6-Aug	41	82.5	59.1	0
7-Aug	42	76.7	66.5	1.5
8-Aug	43	77.3	63.1	0.1
9-Aug	44	83.3	58.6	0
10-Aug	45	81.2	58.4	0
11-Aug	46	82.5	62.7	0
12-Aug	47	80.4	70.4	1.19
13-Aug	48	84.3	67.9	0.19
14-Aug	49	81.3	64.5	0
15-Aug	50	80.9	71.5	0.69
16-Aug	51	88.2	72.3	0
17-Aug	52	85.7	70.1	0

18-Aug	53	90.6	72.5	1.41
Date	DAP	Max Temp °F	Min Temp °F	Rainfall (in.)
19-Aug	54	87.0	72.6	0
20-Aug	55	84.2	65.9	0
21-Aug	56	86.2	63.5	0
22-Aug	57	89.2	74.3	0
23-Aug	58	83.2	68.7	0
24-Aug	59	81.7	62.5	0
25-Aug	60	79.4	61.0	0
26-Aug	61	78.7	59.8	0
27-Aug	62	76.5	57.1	0
28-Aug	63	75.6	55.4	0
29-Aug	64	69.3	64.9	0
30-Aug	65	75.8	61.5	0
31-Aug	66	83.4	62.2	0.02
1-Sep	67	70.3	59.0	0
2-Sep	68	69.4	59.1	0.76
3-Sep	69	75.3	63.0	0
4-Sep	70	80.2	57.5	0
5-Sep	71	85.7	68.2	0.52
6-Sep	72	78.1	61.9	0.48
7-Sep	73	73.4	55.7	0.02
8-Sep	74	74.7	51.4	0
9-Sep	75	71.7	52.3	0
10-Sep	76	71.7	49.4	0
11-Sep	77	73.9	50.8	0
12-Sep	78	75.4	56.4	0
13-Sep	79	84.2	61.8	0.04
14-Sep	80	79.9	66.5	0
15-Sep	81	81.9	63.6	0.03
16-Sep	82	83.7	65.2	0
17-Sep	83	80.4	63.4	0.01
18-Sep	84	76.3	68.6	0
19-Sep	85	74.7	68.9	0.39
20-Sep	86	83.8	68.0	0
21-Sep	87	85.1	64.5	0
22-Sep	88	79.5	65.9	0
23-Sep	89	85.3	61.8	0
24-Sep	90	86.8	60.5	0
25-Sep	91	84.3	60.9	0
26-Sep	92	77.4	67.8	0
27-Sep	93	83.4	72.0	0
28-Sep	94	81.2	57.7	0
29-Sep	95	71.6	50.2	0
30-Sep	96	67.6	49.5	0
1-Oct	97	67.9	46.0	0
2-Oct	98	73.4	44.0	0

Appendix F: Weather Conditions During 2017 Fordhook Variety Trial June 26th (planting) to October 2nd (final harvest)



Acknowledgements

The authors gratefully acknowledge:

Extension Vegetable Program employees: Savanna Weaber, Kenna Hunt, Brandon Hunt and Danielle Vanderhei who helped to plant, maintain and harvest the plots.

ADM-Seedwest for participating in the baby lima trial

Kenny Gauen from The Pictsweet Company for providing seed for standard varieties and border rows.

Brian Hearn and the REC Farm Crew for help with field operations and viner maintenance.