

**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**

2015

**2015 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

2015 Baby Lima Bean Variety Trials

In 2015 three 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, an irrigated trial of newly developed breeding lines and an unirrigated trial of advanced breeding lines.

Unirrigated Baby Lima Bean Variety Trial at Georgetown, DE- Planted May 27, 2015

The Unirrigated Baby Lima Bean Variety Trial included a total of 31 lines and was planted on May 27. The purpose of this trial was to evaluate advanced breeding material from the UD Lima Bean Breeding Program that had been selected under dryland conditions. This trial was not irrigated and was planted in late May expose the entries to heat stress during flowering. Trial entries were evaluated for yield and days to harvest.

Trial Location:

Field 12B at the University of Delaware Research and Education Center Farm, Georgetown, DE

Plot Setup and Cultural Practices:

The trial was planted by hand on May 27, 2015 into rows marked 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 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 four replications. The field was fertilized with potassium (0-0-60) before planting according to soil test results. A pre-emergence application of 1 pt/A Dual II Magnum + 0.75 oz/A Sandea + 1 pt/A Prowl for weed control as well as 49 lbs/A nitrogen in the form of 30% UAN was made after planting. Plots were cultivated once. One sidedress application of 49 lbs/A nitrogen in the form of 30% UAN was made. Additional hand weeding was done as necessary. Weed control in the trial was good. Hero at 10 oz/A was applied on August 22 for stinkbugs. No disease was observed in the plot.

Harvest:

Hot dry weather as the pods were maturing caused quick dry down. All plots in a block/replication were harvested on the same day. Harvest began on September 14 (110 DAP) and ended on September 18 (114 DAP).

A 10-foot section from each plot was harvested. The plants were cut off at soil level, counted 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 beans from each plot was weighed and then used to estimate yield in terms of seeds per plot.

Lines Evaluated in the Unirrigated Baby Lima Bean Trial Planted May 27, 2015

Line	Description
C-elite Select	standard variety
Cypress	standard variety
DE0407905	UD breeding line
DE0407907	UD breeding line
DE0505002A	UD breeding line
DE0802101A	UD breeding line
DE0900705C	UD breeding line
DE0901502B	UD breeding line
DE0901601B	UD breeding line
DE1000404A	UD breeding line
DE1000701B	UD breeding line
DE1000802B	UD breeding line
DE1001104B	UD breeding line
DE1001202B	UD breeding line
DE1001202C	UD breeding line
DE1103901B	UD breeding line
DE1104002B	UD breeding line
DE1104102B	UD breeding line
DE1104301A	UD breeding line
DE1104301B	UD breeding line
DE1104301D	UD breeding line
DE1104304C	UD breeding line
DE1105302A	UD breeding line
DE1105302B	UD breeding line
DE1105303B	UD breeding line
DE1105604A	UD breeding line
DE1105604B	UD breeding line
DE1106301A	UD breeding line
DE1106303A	UD breeding line
DE1106306A	UD breeding line
DE1106306B	UD breeding line

Irrigated Baby Lima Bean Variety Trial at Georgetown, DE – Planted June 9, 2015

The Irrigated Baby Lima Bean Variety Trial was planted on June 9 and included a total of 47 lines. Eight of the lines were entered by the two participating seed companies: ADM Seedwest and Ben Fish & Son. Thirty-five 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, 2015

Variety Name	Source	Variety Name	Source
Cypress	ADM (standard variety)	DE0900705C	University of Delaware
Meadow	ADM (standard variety)	DE0901201A	University of Delaware
G200381	ADM	DE0901204A	University of Delaware
G200382	ADM	DE0901502B	University of Delaware
G0026023	ADM	DE0901601B	University of Delaware
G9002033	ADM	DE1000404A	University of Delaware
G1054294	ADM	DE1000701A	University of Delaware
G1055283	ADM	DE1000701B	University of Delaware
G3041405	ADM	DE1000802B	University of Delaware
184-85	Ben Fish (standard variety)	DE1000802C	University of Delaware
M-15	Ben Fish	DE1000901B	University of Delaware
C-elite Select	Ben Fish (standard variety)	DE1001102A	University of Delaware
DE0407905	University of Delaware	DE1001102B	University of Delaware
DE0407907	University of Delaware	DE1001102E	University of Delaware
DE0505002A	University of Delaware	DE1001104B	University of Delaware
DE0802101A	University of Delaware	DE1001201A	University of Delaware
DE0802102A	University of Delaware	DE1001201C	University of Delaware
DE0802102B	University of Delaware	DE1001202B	University of Delaware
DE0802102C	University of Delaware	DE1001202C	University of Delaware
DE0802701B	University of Delaware	DE1001202E	University of Delaware
DE0900603A	University of Delaware	DE1001802A	University of Delaware
DE0900604A	University of Delaware	DE1002002A	University of Delaware
DE0900604B	University of Delaware	DE1002003A	University of Delaware
DE0900701D	University of Delaware		

Location:

Field 19B at the University of Delaware Research and Education Center Farm, Georgetown, DE

Cultural Practices:

The trial was planted on June 9, 2015 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 pt/A Dual II Magnum + 0.75 oz/A Sandea for weed control as well as 40 lbs/A nitrogen in the form of 30% UAN was made after planting. Plots were cultivated three times. One sidedress application of 49 lbs/A nitrogen in the form of 30% UAN was made. Additional hand weeding was done as necessary. Weed control in the trial was good. Hero at 10 oz/A was applied on August 22 for stinkbugs, which may have reduced yield in some of the early to mid-season maturing varieties. 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 21 (73 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, 2015**

The Irrigated First Year Trial of Baby Lima Bean Breeding Lines was planted on June 9 and included a total of 21 lines. Seventeen 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. Two lines were standard commercial cultivars and two were high yielding advanced breeding lines from the UD breeding program. 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 9, 2015

Variety Name	Description	Variety Name	Description
Cypress	commercial standard	DE1100801A	UD Breeding Line
C-elite Select	commercial standard	DE1100805A	UD Breeding Line
DE0505002A	UD advanced line	DE1100805B	UD Breeding Line
DE0407907	UD advanced line	DE1101002A	UD Breeding Line
DE1100102B	UD Breeding Line	DE1101102A	UD Breeding Line
DE1100303A	UD Breeding Line	DE1101107A	UD Breeding Line
DE1100401A	UD Breeding Line	DE1101207A	UD Breeding Line
DE1100402B	UD Breeding Line	DE1101301B	UD Breeding Line
DE1100503A	UD Breeding Line	DE1101404A	UD Breeding Line
DE1100704A	UD Breeding Line	DE1101404B	UD Breeding Line
DE1100704B	UD Breeding Line		

Location:

Field 19A at the University of Delaware Research and Education Center Farm, Georgetown, DE

Cultural Practices:

The trial was planted on June 9, 2015 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 pt/A Dual II Magnum + 0.75 oz/A Sandea for weed control as well as 40 lbs/A nitrogen in the form of 30% UAN was made after planting. Plots were cultivated three times. One sidedress application of 49 lbs/A nitrogen in the form of 30% UAN was made. Additional hand weeding was done as necessary. Weed control in the trial was good. Hero at 10 oz/A was applied on August 22 for stinkbugs, which may have reduced yield in some of the early to mid-season maturing varieties. 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 21 (73 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. 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 Irrigated Baby Lima Trial

Days to harvest for the three standard varieties, Cypress, C-elite Select and 184-85 were similar to historical average. There was not a period of sustained high night temperatures during flowering, which causes flower and pin pod abortion. A comparison of days to harvest for the standard varieties versus the historical average is as follows:

Variety	Days to Harvest in Irrigated Baby Lima Trials						
	Average 2006-2009	2010	2011	2012	2013	2014	2015
Planting Date		June 6	June 6	June 14	June 13	June 13	June 9
Cypress	77	91	97	82	77	82	79
C-elite Select	84	96	98	89	89	91	86
184-85	86	95	99	88	89	86	87

Split sets were not a problem in the irrigated trial baby lima trials this year, although high levels of green stinkbug pressure in mid-August may have reduced yield in some of the early and mid-season varieties.

Weather and Pod Set for the Dryland Baby Lima Trial

The dryland baby lima trial was planted on May 27 and received 14.09 inches of rain during the growing season. Dry periods at flowering and pod fill reduced yields in this plot.

Yield and Maturity in the May 27 Planted Dryland Baby Lima Trial

The purpose of the May 27-planted, dryland baby lima trial was to evaluate some of the advanced breeding material from the University of Delaware that has been selected in dryland conditions. The dryland trial was very stressed and produced low yields this year. There were statistically significant differences in yield between some of the varieties in this trial (Table 1) but no varieties had significantly higher yields than C-elite Select and only DE0901601B had a significantly higher yield than Cypress.

Yield and Maturity in the June 9 Planted Baby Lima Trial

The purpose of the June 9-planted 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 2). Yields were high in this trial, due to favorable temperatures for pod set and pod fill, but not as high as the 2014 trial. The highest yielding varieties in the 2015 trial were DE0505002A, DE0900604B, DE1001104B, DE0900701D, DE0901601B, DE0900604A, DE1001102E, DE0901201A, DE1001201A, DE0802101A, DE0900603A, and DE0802102A. DE0505002A, DE0900604B and DE1001104B had a significantly higher yield than C-elite Select, which produced 4503 lbs/A in this trial. Of the top yielding varieties, only DE1001104B is green-seeded (Table 4 and Figure 1). DE0802101A matured in 77 days and was among the highest yielding varieties (Table 4 and Figure 1). Three varieties that matured extremely early in this trial, DE1000701B, DE0900705C, and DE1000701A, are also of interest. DE1000701B, and DE1000701A had lower yields compared to others in the trial but matured four and five days earlier than Cypress, respectively.

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

DE0407905 matured in 86 days and yielded 4312 lbs/A. Yield in this trial was significantly higher than Cypress, but not significantly different than any of the other check varieties. *Plant Variety Protection has been obtained for DE0407905 and it is being released as a cultivar named 'Brooke'.*

DE0407907 matured in 87 days and yielded 4251 lbs/A. Yield in this trial was significantly higher than Cypress, but not significantly different than any of the other check varieties. DE0407907 is resistant to race F of downy mildew. *Plant Variety Protection has been obtained for DE0407907 and it is being released as a cultivar named 'Bert'.*

DE1001104B matured in 87 days and yielded 5565 lbs/A. Yield was significantly higher than all of the check varieties: C-elite Select, GBL 184-85, Cypress and Meadow. This is the second year that DE1001104B has been evaluated in the trial. It was also among the top yielding varieties in 2014.

DE1001202C matured in 83 days and yielded 4317 lbs/A. Yield was not significantly different than C-elite Select, 184-85 or Meadow in this trial. Yield was significantly higher than Cypress. In 2014, DE1001202C was very similar in yield and maturity to DE0505002A, which is one of its parents and has been consistently high yielding in past trials. DE0505002A has green cotyledons but a light colored seed coat. DE1001202C has better seed quality characteristics than DE0505002. This year DE1001202C had similar maturity to DE0505002A but significantly lower yield. Additional testing will be needed to test DE1001202C's yield stability. DE10001202C is resistant to race F of downy mildew.

DE1001202B matured in 83 days and yielded 4589 lbs/A. Yield was not significantly different than C-elite Select or 184-85 in this trial. Yield was significantly higher than Cypress and Meadow. DE1001202B was very similar in yield and maturity to DE0505002A, which is one of its parents and has been consistently high yielding in past trials. DE0505002A has green cotyledons but a light colored seed coat. DE1001202C has better seed quality characteristics than DE0505002. Additional testing will be needed to confirm DE10001202B's yield stability and maturity characteristics.

DE1000802B matured in 83 days and yielded 4232 lbs/A. Yield was not significantly different than C-elite Select, 184-85 or Meadow in this trial. Yield was significantly higher than Cypress. DE1000802B has good seed quality characteristics and matured significantly earlier than 184-85. DE1000802B is resistant to race F of downy mildew. This is the second year of yield testing for DE1000802B; it will be included in future trials to confirm its yield and maturity characteristics.

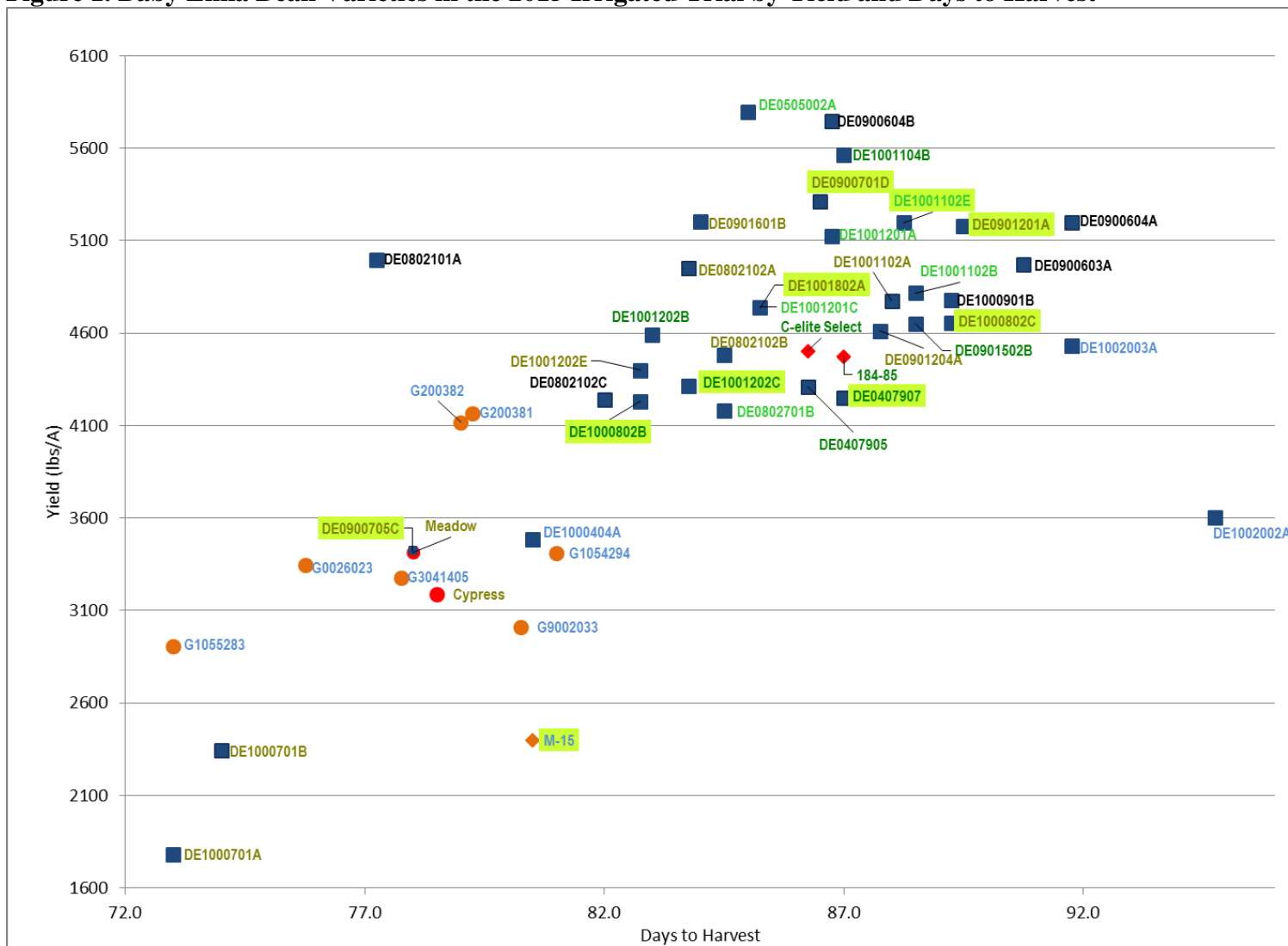
Among the varieties entered by ADM, G200381 and G200382 had yields that were significantly higher than that of Cypress. G200381 and G200382 also performed well in the 2011, 2012, 2013 and 2014 trials. Maturity for these two varieties was nearly identical to Cypress in this trial and also in most past trials.

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 more variable this year than it was in 2012 or 2013 and similar to what was observed in 2014. 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.

The breeding lines from the University of Delaware program that were evaluated in the trial are not all green seeded and exhibit a range of seed sizes. At harvest 100 succulent seeds from each plot were weighed as an indicator of seed size. The 100 seed weights, seedcoat color, cotyledon color, and yield for each variety in the trial are given in Table 4. Most of the lines in the trial did not have seed weights that were significantly different than C-elite Select (Figure 3), although six of the UD breeding lines were significantly larger than C-elite Select and Cypress. As in 2014, DE1000802C had the largest seed and in the 2014 evaluation it was rated as unacceptably large by one of six evaluators.

This year, 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, but was located in a lower and wetter part of the field. Overall, yields in this trial were higher and varieties took longer to mature. The results from this trial are in Table 5. Eight of the lines from this trial will be advanced to evaluation in the main irrigated trial in 2106: DE1101301B, DE1100102B, DE1100402B, DE1100401A, DE1100704A, DE1100805B, DE1101207A, and DE1100303A.

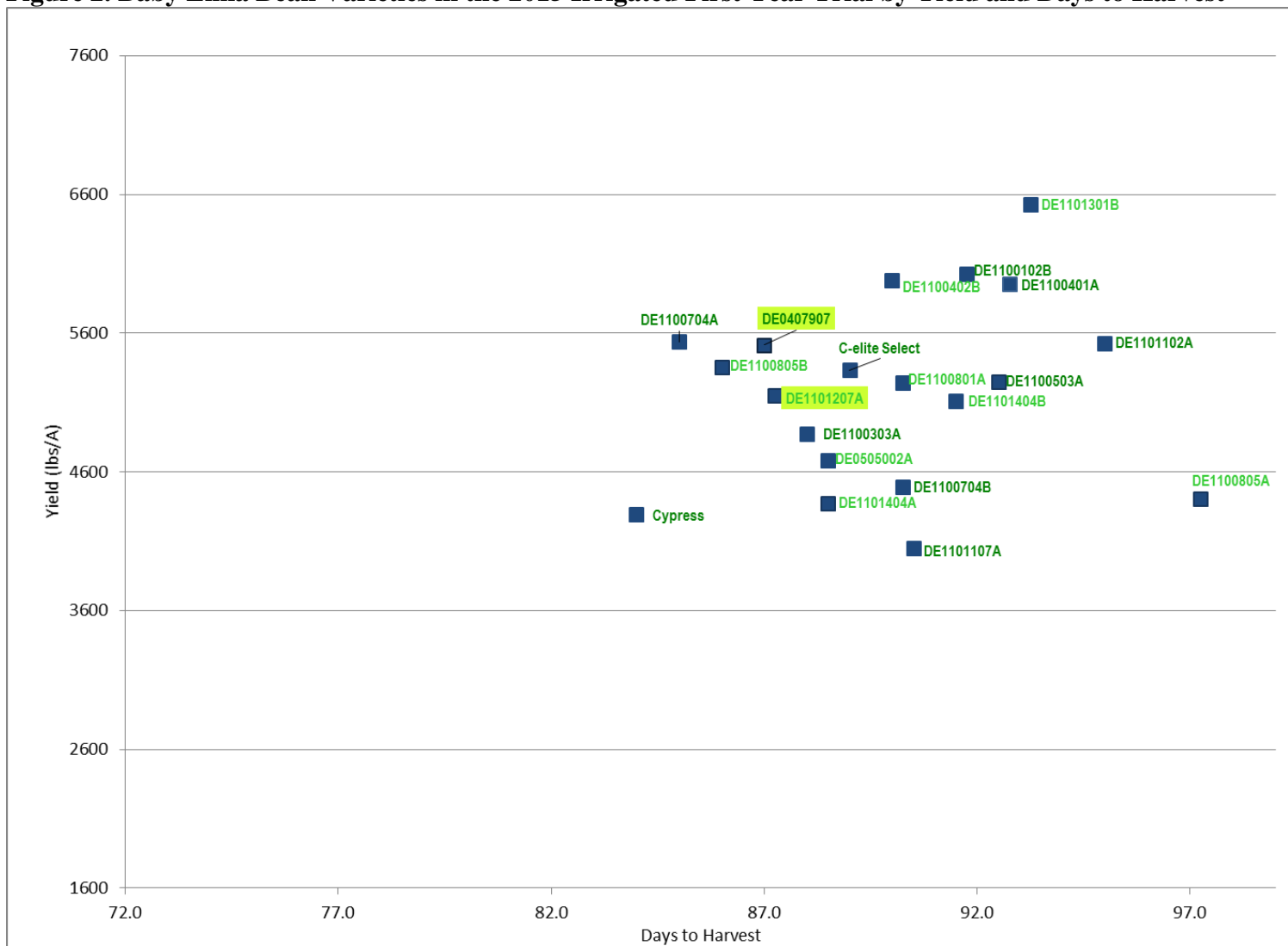
Figure 1. Baby Lima Bean Varieties in the 2015 Irrigated Trial by Yield and Days to Harvest*



* color of data label indicates seed color: **Green**, rated acceptable by all evaluators, **Green**, rated acceptable by most evaluators, **Green**, but color not rated acceptable by most evaluators or not evaluated, **Not Evaluated**, **Not Green**.

Green highlight=resistant to race F of downy mildew.

Figure 2. Baby Lima Bean Varieties in the 2015 Irrigated First Year Trial by Yield and Days to Harvest*



* color of data label indicates seed color: **Green, by visual rating of succulent seed, Light Green, by visual rating of succulent seed.**
Green highlight—resistant to race F of downy mildew.

Figure 3. Baby Lima Bean Varieties in the 2015 Irrigated Trial by Weight of 100 Succulent Seeds

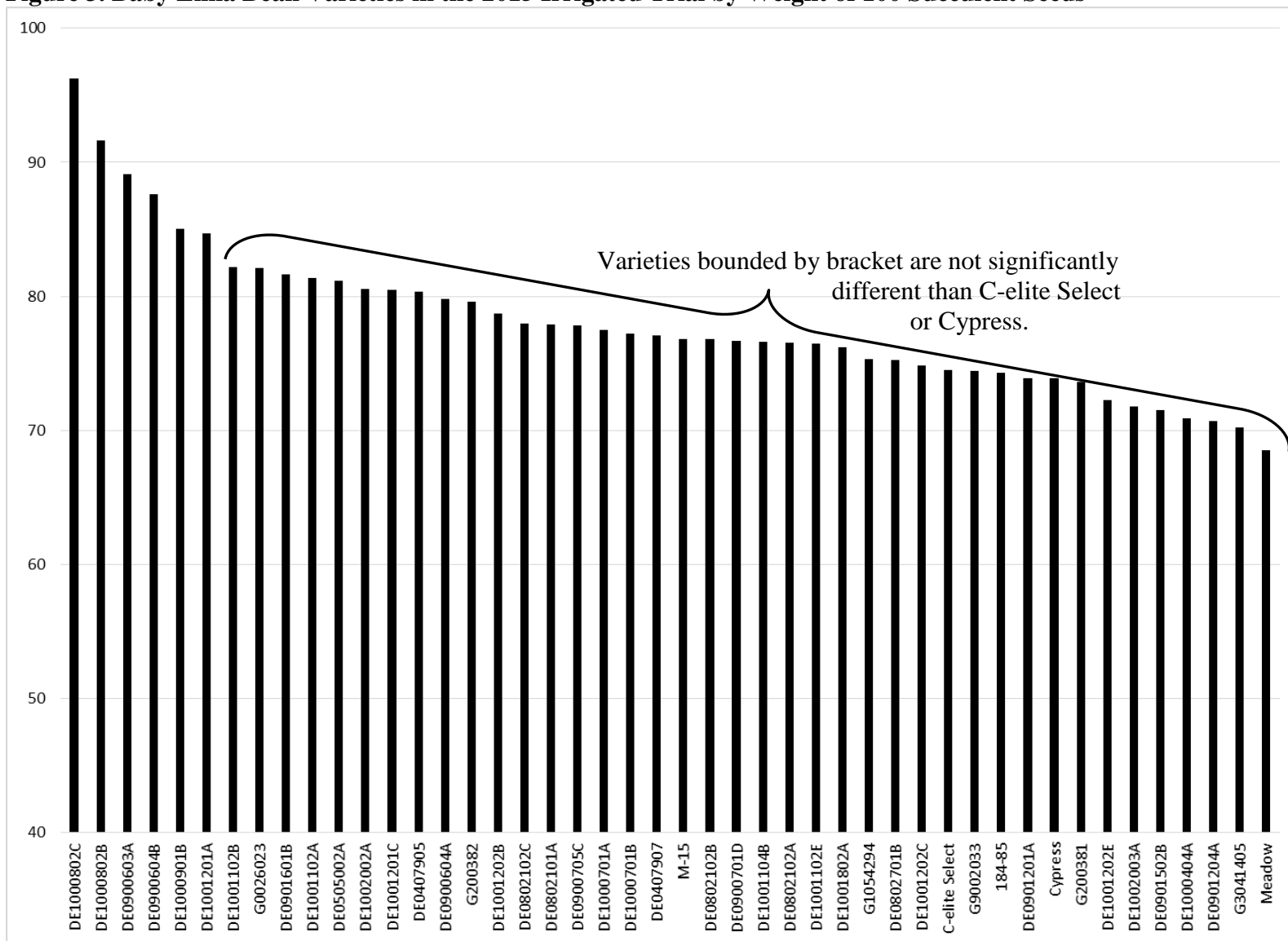


Table 1. Yield, Plant Weight, and Percent Stand at Harvest for the Unirrigated Baby Lima Bean Variety Trial Planted May 27, 2015

Variety ¹	Yield (Lbs/A)	Yield (seeds/plot)	Plant Weight (Lbs/10 ft)	% Stand ²
DE0901601B	2916 a	1343 a	7.6 abcd	93.8 a
DE0505002A	2683 ab	1191 abc	7.9 abc	93.8 a
DE0900705C	2635 abc	1131 abcd	7.1 abcdef	83.1 a
DE1105302A	2622 abc	1184 abc	7.7 abcd	97.5 a
DE1000802B	2603 abc	1217 ab	5.5 ghij	95.6 a
DE1000701B	2589 *	1282 *	6.0 *	97.5 *
DE0407907	2543 abcd	1179 abc	8.2 ab	93.8 a
DE0901502B	2520 abcd	1118 abcd	8.3 ab	95.6 a
DE1103901B	2514 abcd	1144 abcd	8.1 ab	98.1 a
C-elite Select	2508 abcd	1336 a	6.9 bcdefg	89.4 a
DE0802101A	2455 abcde	1217 ab	5.2 hij	100.0 a
DE0407905	2395 abcdef	1016 bcdef	7.9 abc	88.1 a
DE1104304C	2326 bcdef	1070 bcdef	6.1 defghi	97.5 a
Cypress	2324 bcdef	1255 ab	6.0 efghi	92.5 a
DE1001104B	2269 *	1044 *	6.4 *	96.7 *
DE1106306A	2251 bcdef	1108 abcde	6.3 cdefgh	96.3 a
DE1105303B	2218 bcdef	1154 abcd	5.5 fghij	96.3 a
DE1104002B	2213 bcdef	922 def	8.7 a	91.9 a
DE1105604A	2209 bcdef	1159 abcd	6.4 cdefgh	99.4 a
DE1105302B	2195 bcdefg	1045 bcdef	7.4 abcde	95.6 a
DE1104102B	2090 cdefgh	1031 bcdef	8.5 a	93.1 a
DE1106301A	2015 *	1062 *	5.4 *	92.5 *
DE1001202C	1988 defgh	1041 bcdef	6.2 defghi	90.6 a
DE1104301D	1988 defgh	1068 bcdef	5.8 efghij	96.3 a
DE1001202B	1903 efgh	962 cdef	5.5 ghij	93.8 a
DE1105604B	1855 fgh	1104 abcde	5.6 fghij	92.5 a
DE1106303A	1741 *	989 *	4.2 *	75.8 *
DE1106306B	1650 gh	835 f	4.7 ij	88.8 a
DE1104301B	1644 gh	862 ef	4.4 j	96.3 a
DE1104301A	1638 h	866 ef	5.1 hij	93.1 a
DE1000404A	1552 *	783 *	4.2 *	80.0 *
<i>p-value</i>	<0.0001	0.0025	<0.0001	0.0996
Fisher's LSD³	557.0	246.9	1.589	NA
Tukey's HSD⁴	1068.1	473.4	3.0472	NA

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. * indicates averages of less than four replications not included in the statistical analysis.

⁴Minimum significant difference according to Tukey's HSD.

Table 2. Days to Harvest, Yield, Maturity at Harvest, Pods per Plant, Plant Weight, and Percent Stand for the Irrigated Baby Lima Bean Variety Trial Planted June 9, 2015

Variety ¹	Days to Harvest	Yield (Lbs/A)	% Full Pods	% Flat Pods	% Dry Pods	# Pods/Plant	Plant Weight (Lbs/15 ft)	% Stand ²
DE0505002A	85.0 e-k	5794 a	89.1 a	2.0 i	8.9 f-i	24.9 a-h	26.5 a-d	96.8 a-d
DE0900604B	86.8 d-i	5748 ab	84.2 a-d	1.6 i	14.3 c-i	28.7 a-d	23.7 b-k	92.0 b-h
DE1001104B	87.0 c-h	5565 a-c	81.8 a-e	3.4 hi	14.9 c-i	30.2 ab	24.2 a-i	97.0 a-d
DE0900701D	86.5 d-j	5314 a-d	83.5 a-d	8.3 c-i	8.2 g-i	28.0 a-e	28.0 a	95.5 a-g
DE0901601B	84.0 g-m	5204 a-e	82.1 a-e	3.1 hi	14.9 c-i	30.6 a	24.8 a-g	94.0 a-g
DE0900604A	91.8 ab	5200 a-e	72.2 b-k	3.0 hi	24.8 a-d	22.6 c-j	25.2 a-f	93.3 a-h
DE1001102E	88.3 b-f	5196 a-e	70.3 b-l	13.2 c-h	16.5 c-i	23.3 b-i	27.9 ab	94.3 a-g
DE0901201A	89.5 b-d	5178 a-e	77.5 a-h	9.7 c-i	12.8 d-i	28.1 a-e	26.4 a-d	93.0 a-h
DE1001201A	86.8 d-i	5126 a-f	77.9 a-h	7.8 c-i	14.3 c-i	24.7 a-h	25.9 a-e	96.0 a-f
DE0802101A	77.3 q-s	4995 a-g	69.8 d-l	11.5 c-i	18.7 b-i	18.6 g-k	24.7 a-h	94.0 a-g
DE0900603A	90.8 bc	4971 a-g	79.7 a-f	4.6 g-i	15.7 c-i	23.2 b-i	25.8 a-e	95.0 a-g
DE0802102A	83.8 h-m	4953 a-g	69.8 d-l	1.5 i	28.7 a-c	23.8 a-h	21.8 e-m	95.0 a-g
DE1001102B	88.5 b-e	4816 b-g	80.3 a-f	5.1 g-i	14.6 c-i	24.6 a-h	23.8 a-k	89.3 d-i
DE1000901B	89.3 b-d	4779 b-g	81.3 a-e	9.8 c-i	8.9 f-i	23.8 a-i	28.0 a	90.8 c-h
DE1001102A	88.0 b-f	4774 b-g	77.5 a-h	6.4 d-i	16.1 c-i	29.5 a-c	25.4 a-f	91.8 b-h
DE1001201C	85.3 e-k	4739 c-g	89.8 a	2.5 i	7.8 g-i	28.1 a-e	24.7 a-h	94.3 a-g
DE1001802A	85.3 e-k	4738 c-g	71.3 b-k	3.7 g-i	25.1 a-d	22.7 c-j	19.8 j-m	88.8 d-i
DE1000802C	89.3 b-d	4656 c-g	68.5 e-m	6.5 d-i	25.0 a-d	20.6 f-k	22.5 d-l	85.3 h-j
DE0901502B	88.5 b-e	4651 c-g	79.2 a-h	4.1 g-i	16.8 c-i	22.4 c-k	22.9 d-l	95.8 a-g
DE0901204A	87.8 c-g	4612 c-g	77.1 a-i	4.5 g-i	18.4 b-i	26.7 a-f	25.0 a-f	93.5 a-h
DE1001202B	83.0 i-n	4589 c-g	84.3 a-c	5.6 e-i	10.2 e-i	24.3 a-h	24.0 a-j	100.8 a
DE1002003A	91.8 ab	4533 d-h	75.3 a-j	3.9 g-i	20.8 b-g	24.3 a-h	23.2 d-k	94.3 a-g
C-elite Select	86.3 d-j	4503 d-h	79.5 a-g	11.3 c-i	9.3 f-i	30.7 a	23.4 d-k	77.0 j-l
DE0802102B	84.5 f-l	4480 d-h	76.0 a-j	4.1 g-i	19.9 b-i	25.3 a-g	21.8 e-m	94.3 a-g
184-85	87.0 c-h	4470 d-h	76.5 a-j	8.4 c-i	15.1 c-i	26.5 a-f	23.8 a-k	87.8 f-i
DE1001202E	82.8 j-o	4400 d-i	81.9 a-e	5.3 f-i	12.8 d-i	23.6 a-i	24.7 a-h	89.0 d-i
DE1001202C	83.8 h-m	4317 e-j	84.5 ab	3.4 hi	12.0 d-i	23.2 b-i	23.5 c-k	96.0 a-f
DE0407905	86.3 d-j	4312 e-j	79.4 a-g	10.8 c-i	9.9 f-i	23.8 a-h	25.3 a-f	96.3 a-e
DE0407907	87.0 c-h	4251 e-k	73.4 b-j	6.1 e-i	20.5 b-i	21.3 e-k	24.2 a-i	95.0 a-g
DE0802102C	82.0 k-p	4242 e-k	65.1 g-m	2.6 i	32.4 ab	18.1 g-k	21.2 f-m	90.5 c-h
DE1000802B	82.8 j-o	4232 e-k	68.6 e-m	6.7 d-i	24.7 a-e	17.6 h-k	21.2 f-m	98.8 a-c
DE0802701B	84.5 f-l	4179 f-k	77.2 a-i	7.1 d-i	15.7 c-i	20.6 f-k	23.5 c-k	92.8 a-h
G200381	79.3 n-r	4165 f-k	70.4 b-l	4.6 g-i	25.0 a-d	22.3 c-k	20.6 g-m	89.0 d-i
G200382	79.0 o-r	4118 g-l	62.2 j-m	15.8 b-f	22.1 a-g	18.4 g-k	22.5 d-l	94.3 a-g
DE1002002A	94.8 ab	3603 h-m	74.0 b-j	7.0 d-i	19.1 b-i	22.1 d-k	27.8 a-c	87.5 g-i
DE1000404A	80.5 m-q	3483 i-m	66.4 f-m	24.0 ab	9.6 f-i	21.8 d-k	21.7 e-m	95.8 a-g
DE0900705C	78.0 qr	3424 j-m	67.9 e-m	17.9 bc	14.2 c-i	23.2 b-i	23.1 d-k	88.3 e-i
<i>p-value</i>	<0.0001	<0.0001	<0.0001	<0.0001	0.0063	<0.0001	<0.0001	<0.0001
Fisher's LSD ³	3.7947	976	14.524	10.499	14.624	7.2892	4.3171	8.2904
Tukey's HSD ⁴	7.7694	1998	29.736	21.497	29.941	14.924	8.839	16.974

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. * indicates averages of less than four replications not included in the statistical analysis.

⁴Minimum significant difference according to Tukey's HSD.

Table 2 continues on the next page.

Table 2 (Continued). Days to Harvest, Yield, Maturity at Harvest, Pods per Plant, Plant Weight, and Percent Stand for the Irrigated Baby Lima Bean Variety Trial Planted June 9, 2015

Variety ¹	Days to Harvest	Yield (Lbs/A)	% Full Pods	% Flat Pods	% Dry Pods	# Pods/Plant	Plant Weight (Lbs/15 ft)	% Stand ²
Meadow	78.0 qr	3415 j-m	58.0 k-m	15.7 b-f	26.3 a-d	15.5 jk	20.4 h-m	96.0 a-f
G1054294	81.0 l-q	3412 j-m	83.7 a-d	10.2 c-i	6.2 i	30.7 a	20.1 i-m	61.5 m
G0026023	75.8 r-t	3345 j-n	73.4 b-j	11.1 c-i	15.5 c-i	21.2 e-k	18.1 m	71.3 l
G3041405	77.8 q-s	3276 k-o	69.8 c-l	16.8 b-d	13.5 d-i	30.6 a	18.1 m	70.0 l
Cypress	78.5 p-r	3189 l-o	55.1 m	8.5 c-i	36.4 a	16.5 i-k	19.7 k-m	75.5 kl
G9002033	80.3 m-q	3012 m-o	62.7 i-m	14.1 b-g	23.3 a-f	15.2 k	19.6 k-m	100.0 ab
G1055283	73.0 t	2908 m-o	56.3 lm	33.9 a	9.8 f-i	15.5 jk	21.1 f-m	91.8 b-h
M-15	80.5 m-q	2400 no	72.2 b-k	15.8 b-e	12.0 d-i	20.0 f-k	18.6 lm	81.0 i-k
DE1000701B	74.0 st	2342 o	64.8 h-m	28.7 a	6.5 hi	17.6 h-k	19.8 j-m	95.3 a-g
DE1000701A	73.0 *	1782 *	75.9 *	18.3 *	5.8 *	19.5 *	18.6 *	90.0 *
<i>p-value</i>	<0.0001	<0.0001	<0.0001	<0.0001	0.0063	<0.0001	<0.0001	<0.0001
Fisher's LSD³	3.7947	976	14.524	10.499	14.624	7.2892	4.3171	8.2904
Tukey's HSD⁴	7.7694	1998	29.736	21.497	29.941	14.924	8.839	16.974

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. * indicates averages of less than four replications not included in the statistical analysis.

⁴Minimum significant difference according to Tukey's HSD.

Table 3. Average Days to Harvest and Standard Deviation of Days to Harvest for the Irrigated Baby Lima Bean Variety Trial Planted June 9, 2015

Variety	Average Days to Harvest	Standard Deviation of Days to Harvest*
G1055283	73.0	0.00
DE1001202B	83.0	0.00
DE0900604B	86.8	0.50
DE0900701D	86.5	0.58
C-elite Select	86.3	0.96
DE0407905	86.3	0.96
Meadow	78.0	1.15
DE0802102B	84.5	1.29
G3041405	77.8	1.50
DE0802102A	83.8	1.50
DE0900604A	91.8	1.50
DE1001202C	83.8	1.50
DE1001802A	85.3	1.50
DE1002002A	94.8	1.50
DE1002003A	91.8	1.50
DE0505002A	85.0	1.63
DE1001201C	85.3	1.71
Cypress	78.5	1.73
M-15	80.5	1.73
DE1000701B	74.0	2.00
DE1001102A	88.0	2.00
DE0901204A	87.8	2.22
G1054294	81.0	2.71
DE0407907	87.0	2.71
DE1001104B	87.0	2.71
184-85	87.0	2.83
G200381	79.3	2.87
DE0900603A	90.8	2.87
DE1000802B	82.8	2.87
DE1001201A	86.8	2.87
DE1001202E	82.8	2.87
DE0901502B	88.5	2.89
DE0802701B	84.5	3.00
DE1001102B	88.5	3.00
DE0802101A	77.3	3.10
DE0802102C	82.0	3.16
DE0901601B	84.0	3.16
G0026023	75.8	3.40
G9002033	80.3	3.40
DE0901201A	89.5	3.70
DE1001102E	88.3	3.86

Variety	Average Days to Harvest	Standard Deviation of Days to Harvest
DE1000901B	89.3	3.95
DE0900705C	78.0	4.16
G200382	79.0	5.48
DE1000802C	89.3	5.62
DE1000404A	80.5	6.56
DE1000701A	73.0	*

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, 100 Seed Weight, Seedcoat Color, and Overall Quality Varieties in the 2015 Irrigated Baby Lima Trial

Variety	Yield (lbs/A)	Weight of 100 Succulent Seeds (g)	Seedcoat Color	100% of Evaluators Rating Overall Acceptable
DE0505002A	5794 a	81.16 c-i	light green	100
DE0900604B	5748 ab	87.62 a-d	buff/black speckle	not evaluated
DE1001104B	5565 a-c	76.58 e-m	green	100
DE0900701D	5314 a-d	76.68 e-m	light green	50
DE0901601B	5204 a-e	81.62 c-h	light green	not evaluated
DE0900604A	5200 a-e	79.81 c-k	pink/red speckle	not evaluated
DE1001102E	5196 a-e	76.44 e-m	light green	83
DE0901201A	5178 a-e	73.87 g-m	light green	17
DE1001201A	5126 a-f	84.72 b-f	light green	67
DE0802101A	4995 a-g	77.91 e-m	buff/magenta speckle	17
DE0900603A	4971 a-g	89.11 a-c	pink/red speckle	not evaluated
DE0802102A	4953 a-g	76.53 e-m	light green	33
DE1001102B	4816 b-g	82.18 c-g	light green	83
DE1000901B	4779 b-g	85.01 b-e	greenish buff with hilum ring	not evaluated
DE1001102A	4774 b-g	81.37 c-h	light green	50
DE1001201C	4739 c-g	80.47 c-j	light green	67
DE1001802A	4738 c-g	76.17 e-m	light green	50
DE1000802C	4656 c-g	96.23 a	lt green	50
DE0901502B	4651 c-g	71.50 j-m	green	100
DE0901204A	4612 c-g	70.67 k-m	light green	33
DE1001202B	4589 c-g	78.71 d-k	green	100
DE1002003A	4533 d-h	71.78 i-m	green	100
C-elite Select	4503 d-h	74.48 g-m	green	100
DE0802102B	4480 d-h	76.82 e-m	light green	33
184-85	4470 d-h	74.26 g-m	green	100
DE1001202E	4400 d-i	72.25 h-m	light green	50
DE1001202C	4317 e-j	74.87 g-m	green	100
DE0407905	4312 e-j	80.38 c-j	green	100
DE0407907	4251 e-k	77.11 e-m	green	100
DE0802102C	4242 e-k	77.97 e-m	white	17
DE1000802B	4232 e-k	91.65 ab	lt green	100
DE0802701B	4179 f-k	75.22 g-m	light green	100
G200381	4165 f-k	73.63 g-m	green	not evaluated
G200382	4118 g-l	79.61 d-k	green	not evaluated
DE1002002A	3603 h-m	80.56 c-j		not evaluated
DE1000404A	3483 i-m	70.87 k-m		not evaluated
DE0900705C	3424 j-m	77.84 e-m	light green	33
<i>p-value</i>	<0.0001	<0.0001		
Fishers' LSD¹	976	9.4497		
Tukey's HSD²	1998	19.302		

Table 4 continued on the next page

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

²Minimum significant difference according to Tukey's HSD.

Table 4. Yield, 100 Seed Weight, Seedcoat Color, and Overall Quality Varieties in the 2015 Irrigated Baby Lima Trial *continued*

Variety	Yield (lbs/A)	Weight of 100 Succulent Seeds (g)	Seedcoat Color	100% of Evaluators Rating Overall Acceptable
Meadow	3415 j-m	68.53 m	green	50
G1054294	3412 j-m	75.32 f-m	green	not evaluated
G0026023	3345 j-n	82.08 c-g	green	not evaluated
G3041405	3276 k-o	70.24 lm	green	not evaluated
Cypress	3189 l-o	73.85 g-m	green	33
G9002033	3012 m-o	74.44 g-m	green	not evaluated
G1055283	2908 m-o	--	green	not evaluated
M-15	2400 no	76.82 e-m	green	not evaluated
DE1000701B	2342 o	77.25 e-m	light green	not evaluated
DE1000701A	1782 *	77.50 *	light green	33
<i>p-value</i>	<0.0001	<0.0001		
Fishers' LSD¹	976	9.4497		
Tukey's HSD²	1998	19.302		

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

²Minimum significant difference according to Tukey's HSD.

Table 5. 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, 2015

Variety ¹	Days to Harvest	Yield (Lbs/A)	Plant Weight (Lbs/15 ft)	% Stand ²	Weight of 100 Succulent Seeds (g)	Seed Color
DE1101301B	93.3 abc	6528 a	27.7 cd	96.7 a	90.8 a	light green
DE1100102B	91.8 bcdef	6028 ab	26.9 cde	97.5 a	79.3 bcdef	green
DE1100402B	90.0 cdefgh	5982 ab	28.6 bcd	96.7 a	82.7 abcde	light green
DE1100401A	92.8 bcd	5952 abc	31.9 ab	95.4 a	86.8 ab	green
DE1100704A	85.0 ij	5533 abcd	25.1 defg	100.0 a	73.6 fgh	green
DE1101102A	95.0 ab	5524 abcd	29.6 bc	98.8 a	86.1 abc	green
DE0407907	87.0 ghij	5515 abcd	32.4 ab	95.8 a	77.2 defg	green
DE1100805B	86.0 hij	5355 bcde	27.6 cd	98.3 a	81.2 bcdef	light green
C-elite Select	89.0 defghi	5334 bcde	27.6 cd	91.7 a	73.6 fgh	green
DE1100503A	92.5 bcde	5246 bcde	30.2 abc	98.3 a	78.4 bcdef	green
DE1100801A	90.3 cdefg	5242 bcde	27.7 cd	96.3 a	80.6 bcdef	light green
DE1101207A	87.3 ghij	5149 bcde	27.6 cd	97.9 a	69.7 gh	light green
DE1101404B	91.5 bcdef	5112 bcdef	29.9 abc	97.9 a	83.0 abcde	light green
DE1100303A	88.0 fghij	4877 cdef	26.7 cdef	98.3 a	78.0 cdefg	green
DE0505002A	88.5 efghi	4683 def	28.7 bcd	87.5 a	78.8 bcdef	light green
DE1100704B	90.3 cdefg	4494 def	22.6 fg	95.4 a	67.4 h	green
DE1100805A	97.3 a	4404 ef	34.0 a	90.8 a	84.6 abcd	light green
DE1101404A	88.5 efghi	4370 ef	26.3 cdefg	94.6 a	85.5 abcd	light green
Cypress	84.0 j	4292 ef	22.9 efg	92.5 a	76.0 efg	green
DE1101107A	90.5 cdefg	4050 f	22.1 g	96.3 a	77.1 defg	light green
DE1101002A	84.0 *	3862 *	23.0 *	88.3 *	79.2 *	light green
<i>p-value</i>	<0.0001	0.0009	<0.0001	0.0765	<0.0001	
Fisher's LSD³	4.1508	1093.9	4.1656	NA	8.4908	
Tukey's HSD⁴	7.6999	2029.3	7.7275	NA	15.751	

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. * indicates averages of less than four replications not included in the statistical analysis.

⁴Minimum significant difference according to Tukey's HSD.

Appendix A: Weather Data for 2015 Baby Lima Variety Trials at Georgetown

May 27th (first planting) to September 18th (final harvest)

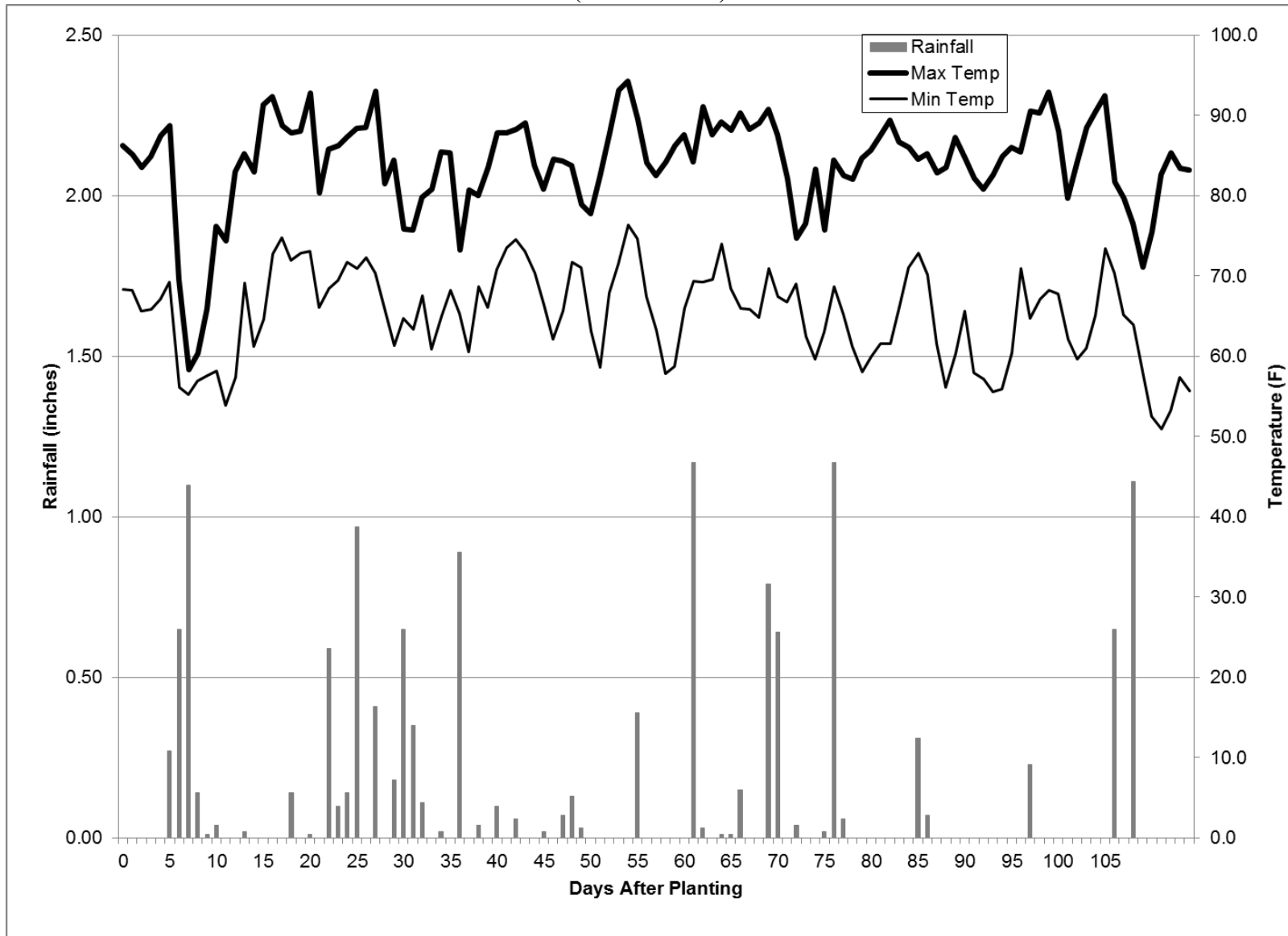
Data from DEOS weather station @ Georgetown, DE-REC: www.deos.udel.edu

Days After Planting		Date	Max Temp °F	Min Temp °F	Rainfall (in.)
May 27 Dryland Trial	June 9 Irrigated Trials				
0		27-May	86.3	68.4	0
1		28-May	85.1	68.2	0
2		29-May	83.6	65.7	0
3		30-May	84.9	65.9	0
4		31-May	87.5	67.1	0
5		1-Jun	88.7	69.3	0.27
6		2-Jun	69.5	56.2	0.65
7		3-Jun	58.4	55.2	1.10
8		4-Jun	60.4	57	0.14
9		5-Jun	65.9	57.6	0.01
10		6-Jun	76.2	58.2	0.04
11		7-Jun	74.4	53.9	0
12		8-Jun	83	57.4	0
13	0	9-Jun	85.3	69.1	0.02
14	1	10-Jun	83	61.2	0
15	2	11-Jun	91.3	64.6	0
16	3	12-Jun	92.4	72.8	0
17	4	13-Jun	88.7	74.8	0
18	5	14-Jun	87.9	72	0.14
19	6	15-Jun	88.1	72.9	0
20	7	16-Jun	92.8	73.1	0.01
21	8	17-Jun	80.4	66.1	0
22	9	18-Jun	85.8	68.5	0.59
23	10	19-Jun	86.3	69.5	0.10
24	11	20-Jun	87.4	71.7	0.14
25	12	21-Jun	88.4	71	0.97
26	13	22-Jun	88.5	72.3	0
27	14	23-Jun	93.1	70.4	0.41
28	15	24-Jun	81.5	65.7	0
29	16	25-Jun	84.5	61.4	0.18
30	17	26-Jun	75.9	64.7	0.65
31	18	27-Jun	75.8	63.4	0.35
32	19	28-Jun	79.8	67.6	0.11
33	20	29-Jun	80.9	60.9	0
34	21	30-Jun	85.5	65	0.02
35	22	1-Jul	85.4	68.3	0
36	23	2-Jul	73.3	65.3	0.89
37	24	3-Jul	80.7	60.6	0
38	25	4-Jul	80	68.7	0.04
39	26	5-Jul	83.6	66.1	0
40	27	6-Jul	87.8	70.8	0.1
41	28	7-Jul	87.9	73.6	0
42	29	8-Jul	88.3	74.6	0.06
43	30	9-Jul	89.1	73.1	0
44	31	10-Jul	83.8	70.4	0
45	32	11-Jul	80.8	66.4	0.02
46	33	12-Jul	84.6	62.2	0
47	34	13-Jul	84.3	65.6	0.07
48	35	14-Jul	83.8	71.7	0.13
49	36	15-Jul	78.9	71.1	0.03

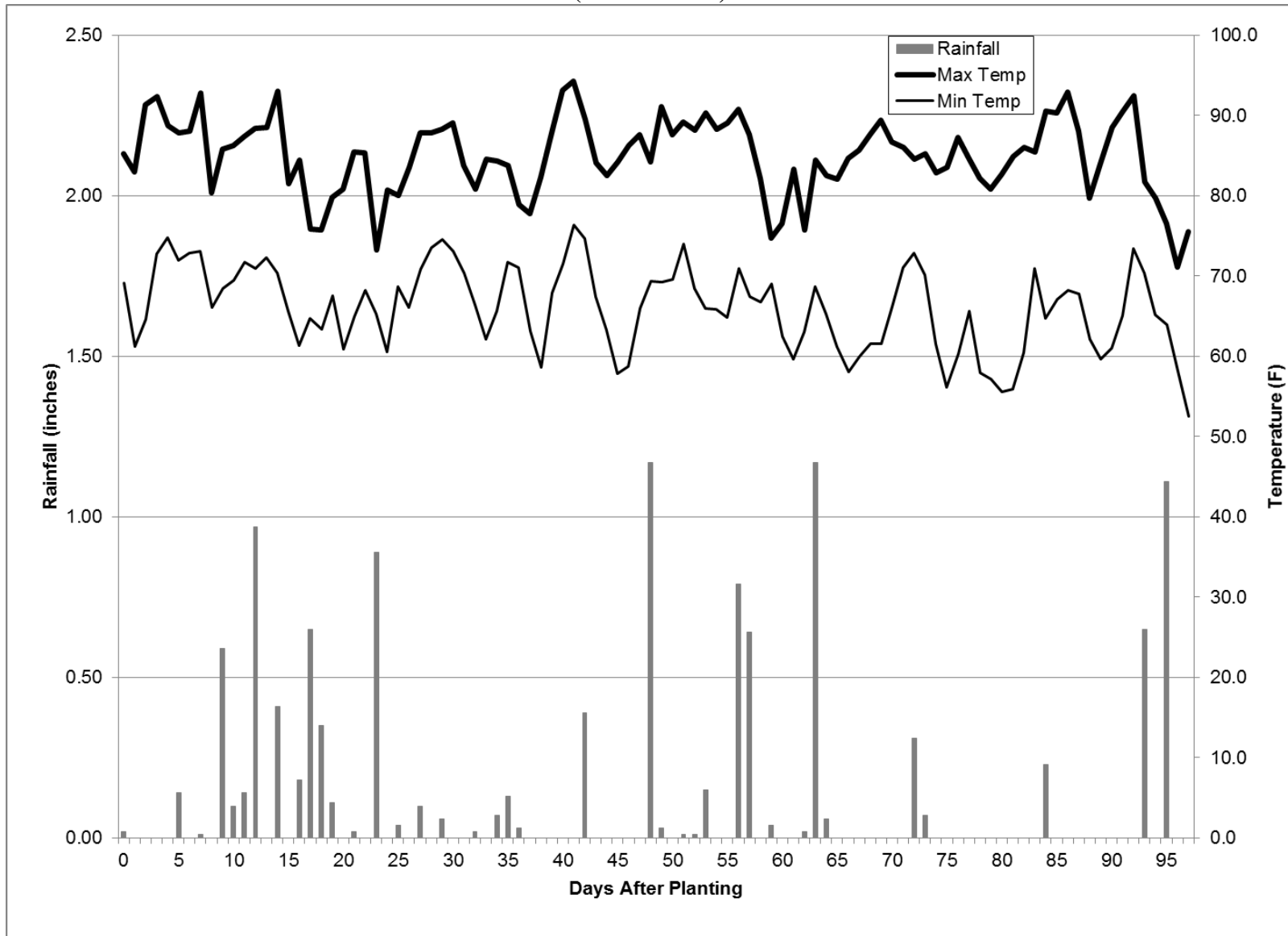
Days After Planting		Date	Max Temp °F	Min Temp °F	Rainfall (in.)
May 27 Dryland Trial	June 9 Irrigated Trial				
50	37	16-Jul	77.8	63.2	0
51	38	17-Jul	82.3	58.6	0
52	39	18-Jul	87.8	67.9	0
53	40	19-Jul	93.2	71.5	0
54	41	20-Jul	94.3	76.4	0
55	42	21-Jul	89.6	74.7	0.39
56	43	22-Jul	84.1	67.5	0
57	44	23-Jul	82.5	63.3	0
58	45	24-Jul	84.2	57.9	0
59	46	25-Jul	86.3	58.7	0
60	47	26-Jul	87.6	66	0
61	48	27-Jul	84.2	69.4	1.17
62	49	28-Jul	91.1	69.3	0.03
63	50	29-Jul	87.6	69.6	0
64	51	30-Jul	89.2	74	0.01
65	52	31-Jul	88.2	68.5	0.01
66	53	1-Aug	90.3	66	0.15
67	54	2-Aug	88.3	65.9	0
68	55	3-Aug	89.1	64.9	0
69	56	4-Aug	90.8	71	0.79
70	57	5-Aug	87.6	67.4	0.64
71	58	6-Aug	82.2	66.8	0
72	59	7-Aug	74.8	69	0.04
73	60	8-Aug	76.6	62.5	0
74	61	9-Aug	83.3	59.7	0
75	62	10-Aug	75.8	63.1	0.02
76	63	11-Aug	84.5	68.7	1.17
77	64	12-Aug	82.5	65.3	0.06
78	65	13-Aug	82.1	61.2	0
79	66	14-Aug	84.7	58.1	0
80	67	15-Aug	85.7	60	0
81	68	16-Aug	87.6	61.6	0
82	69	17-Aug	89.4	61.6	0
83	70	18-Aug	86.7	66.2	0
84	71	19-Aug	86.1	71.1	0
85	72	20-Aug	84.6	72.9	0.31
86	73	21-Aug	85.3	70.2	0.07
87	74	22-Aug	82.9	61.6	0
88	75	23-Aug	83.6	56.2	0
89	76	24-Aug	87.3	60.3	0
90	77	25-Aug	84.7	65.7	0
91	78	26-Aug	82.2	58	0
92	79	27-Aug	80.9	57.2	0
93	80	28-Aug	82.7	55.6	0
94	81	29-Aug	84.9	55.9	0
95	82	30-Aug	86.1	60.4	0
96	83	31-Aug	85.5	71	0
97	84	1-Sep	90.6	64.7	0.23
98	85	2-Sep	90.3	67.1	0
99	86	3-Sep	92.9	68.2	0
100	87	4-Sep	88.1	67.8	0
101	88	5-Sep	79.7	62.2	0

Days After Planting		Date	Max Temp °F	Min Temp °F	Rainfall (in.)
May 29 Dryland Trial	June 13 Irrigated Trial				
102	89	6-Sep	84	59.7	0
103	90	7-Sep	88.5	61	0
104	91	8-Sep	90.6	65.1	0
105	92	9-Sep	92.5	73.4	0
106	93	10-Sep	81.7	70.4	0.65
107	94	11-Sep	79.7	65.2	0
108	95	12-Sep	76.6	63.9	1.11
109	96	13-Sep	71.1	58.2	0
110	97	14-Sep	75.5	52.5	0
111		15-Sep	82.7	51	0
112		16-Sep	85.4	53.2	0
113		17-Sep	83.5	57.4	0
114		18-Sep	83.2	55.7	0

Appendix B: Weather Conditions During the 2015 Dryland Baby Lima Variety Trial May 27th (planting) to September 18th (final harvest)



Appendix C: Weather Conditions During the 2015 Irrigated Baby Lima Variety Trial June 9th (planting) to September 14th (final harvest)



2015 Fordhook Lima Bean Variety Trial

The 2015 Fordhook Lima Bean Variety Trial included a total of 36 lines. Thirty-five 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	DE1101803A	UD Breeding Line
DE0600602B	UD Breeding Line	DE1101902B	UD Breeding Line
DE0600605C	UD Breeding Line	DE1102002A	UD Breeding Line
DE0700904	UD Breeding Line	DE1102103C	UD Breeding Line
DE0701101	UD Breeding Line	DE1102104B	UD Breeding Line
DE0701301A	UD Breeding Line	DE1102104C	UD Breeding Line
DE0701303B	UD Breeding Line	DE1102201A	UD Breeding Line
DE0803801A	UD Breeding Line	DE1102202A	UD Breeding Line
DE0803801B	UD Breeding Line	DE1102202B	UD Breeding Line
DE0804101A	UD Breeding Line	DE1102204E	UD Breeding Line
DE0804404C	UD Breeding Line	DE1102205A	UD Breeding Line
DE0900302A	UD Breeding Line	DE1102206A	UD Breeding Line
DE1002701A	UD Breeding Line	DE1102209A	UD Breeding Line
DE1002703A	UD Breeding Line	DE1102209B	UD Breeding Line
DE1002703B	UD Breeding Line	DE1102209C	UD Breeding Line
DE1101502A	UD Breeding Line	DE1102302A	UD Breeding Line
DE1101503A	UD Breeding Line	DE1102303A	UD Breeding Line
DE1101604A	UD Breeding Line	DE1102401A	UD Breeding Line

Location:

Field 19-B at the University of Delaware Research and Education Center Farm, Georgetown, DE

Cultural Practices:

The trial was hand planted on June 23, 2015 into rows marked with a Monosem planter. Only the Fordhook 242 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 pt/A Dual II Magnum + 0.75 oz/A Sandea for weed control was made after planting. Plots were cultivated once. One sidedress application of 49 lbs/A nitrogen in the form of 30% UAN was made. Additional hand weeding was done as necessary. Weed control in the trial was good. . Hero at 10 oz/A was applied on August 22 for stinkbugs. Bacterial disease was observed in the plot at harvest.

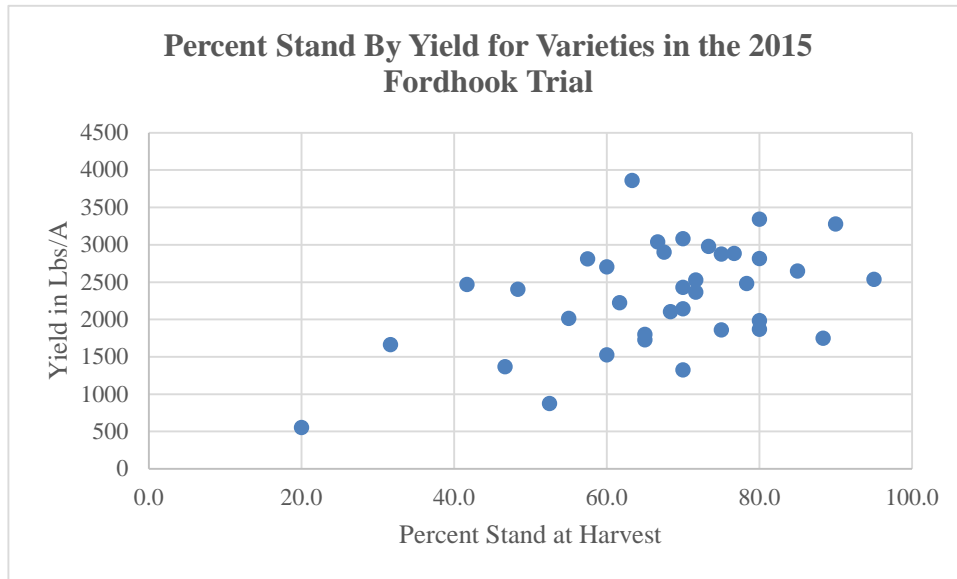
Harvest:

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 22 (91 DAP) and ended on October 5 (104 DAP).

An 8 foot section from each plot was 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. A random sample of 100 succulent beans from each plot was weighed to determine seed size.

Results and Discussion

Seedling emergence in this trial was variable. There is a correlation between final stand at harvest and yield in this trial as illustrated in the chart below, but this correlation is not as strong as what has been observed in past years.



Some of the variability in final stand may have resulted from differences in seed age, quality, and seed treatment, there could also be genetic factors inherent to the variety that influence establishment. The varieties with 85 percent stand or higher at harvest were DE0803801B, DE1101902B, DE0804101A and DE1102202A.

This trial was planted in late June and had lower than typical emergence. Plants were stressed by bacterial stinkbug damage and bacterial disease late in the season. Overall, yields in this trial were lower than usual and there were no statistically significant differences between varieties in terms of yield. The varieties with average yields greater than 3000 lbs/A were DE1102201A, DE1002703A, DE1101902B, DE0600602B, and DE1102209B (Table 6). The standard variety, Fordhook 242, yielded 2430 lbs/A.

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

DE0600605C has had consistently high yields in the five years it was trialed from 2010 to 2014. In 2015 it did not perform as well, possibly because of poor emergence. The five year average yield for this line from 2011 to 2015 is 4337 lbs/A, or 116% of the yield of Fordhook 242 for those same years. DE0600605C was rated unacceptable for commercial production because of its light colored seed by the majority of evaluators in 2012 and 2014. It has been used as a parent for numerous Fordhook breeding lines that are still in development in the program.

DE0600602B has had consistently high yields in the six years it has been trialed from 2010 to 2015. The five year average yield for this line from 2011 to 2105 is 4061 lbs/A, or 108% of the yield of Concentrated Fordhook for those same years. DE0600602B was rated unacceptable for commercial production because of its light colored seed by the majority of evaluators in 2012 and 2014. It has been used as a parent for numerous Fordhook breeding lines that are still in development in the program.

DE0701301A has been tested for five years and has performed well all years except 2015. The four year average yield for this line is 3721 lbs/A, or 88% of the yield of Fordhook 242 for those same years. Yield is not as high or as stable as the DE0600605C, but DE0701301A was rated overall acceptable by all of the 2012 evaluators and by half of the 2014 evaluators. It also had excellent emergence and final stand in the 2012, 2013 and 2014 trials.

DE0900302A has been tested for three years and has a three-year average yield of 3594 lbs/A or 75% of the yield of Fordhook 242 for the same years. DE0900302A has green seed and was rated acceptable by all of the evaluators in 2014.

DE1002703A has been tested for two years and has an average yield of 3574 lbs/A or 91% of the yield of Fordhook 242 for the same years. DE1002703A has green seed and was rated acceptable by all of the evaluators in 2014. This line is also resistant to race F of downy mildew.

Table 6. Days to Harvest, Yield, Maturity at Harvest, Number of Pods per Plant, Plant Weight, and Percent Stand at Harvest, for Entries in the 2015 Fordhook Lima Bean Variety Trial

Variety ¹	Days to Harvest	Yield (Lbs/A)	% Full Pods	% Flat Pods	% Dry Pods	# Pods/Plant	Plant Weight (lbs/8 ft)	% Stand ²
DE1102201A	96.7 a	3858 a	84.8 a	5.9 ef	9.2 fgh	21.1 ab	11.0 abc	63.3 a
DE1002703A	92.7 a	3344 a	75.8 abcde	4.1 f	20.1 bcdefg	12.3 cdef	8.4 bcdefgh	80.0 a
DE1101902B	94.0 *	3278 *	76.5 *	10.8 *	12.7 *	10.4 *	10.5 *	90.0 *
DE0600602B	95.7 a	3079 a	73.3 bcdef	8.1 cdef	18.6 bcdefg	14.0 cde	9.6 abcde	70.0 a
DE1102209B	97.0 a	3036 a	74.8 abcdef	15.2 abcde	10.0 efgh	13.9 cde	11.4 ab	66.7 a
DE1102104B	94.7 a	2976 a	73.2 bcdef	6.1 def	20.7 bcdef	13.2 cde	10.0 abcd	73.3 a
DE1102206A	98.5 *	2902 *	81.0 *	9.3 *	9.7 *	15.8 *	9.3 *	67.5 *
DE0900302A	93.3 a	2885 a	61.1 gh	12.6 bcdef	26.3 abcd	11.0 def	9.2 bcdef	76.7 a
DE1102002A	99.0 a	2877 a	74.8 abcdef	13.2 bcdef	12.0 efgh	12.1 cdef	12.8 a	75.0 a
DE0700904	96.3 a	2814 a	67.9 cdefgh	15.7 abcde	16.3 cdefgh	12.2 cdef	9.7 abcde	80.0 a
DE1102103C	95.0 *	2808 *	70.4 *	4.4 *	25.2 *	21.9 *	6.5 *	57.5 *
DE1102104C	95.7 a	2703 a	57.9 h	5.8 ef	36.3 a	18.3 abc	8.8 bcdefg	60.0 a
DE1102202A	97.0 *	2646 *	88.1 *	7.4 *	4.5 *	10.3 *	9.0 *	85.0 *
DE0803801B	93.7 a	2535 a	64.1 fgh	5.9 ef	30.0 ab	8.8 ef	7.1 defghi	95.0 a
DE1101503A	91.7 a	2530 a	66.9 defgh	21.4 ab	11.8 efgh	13.8 cde	8.9 bcdefg	71.7 a
DE0701101	97.0 a	2481 a	79.3 ab	9.0 cdef	11.7 efgh	9.6 ef	8.2 bcdefghi	78.3 a
DE0804404C	92.7 a	2467 a	76.6 abcd	7.0 def	16.4 cdefgh	24.9 a	7.2 defghi	41.7 a
FH 242	95.0 a	2430 a	68.1 cdefgh	9.6 cdef	22.3 bcde	11.0 def	7.8 cdefghi	70.0 a
DE1102209A	99.3 a	2402 a	78.3 abc	17.3 abc	4.4 h	17.0 bcd	8.2 bcdefghi	48.3 a
DE0803801A	93.0 a	2365 a	70.1 bcdefg	12.0 bcdef	17.9 bcdefg	12.6 cdef	7.0 defghi	71.7 a
DE0600605C	93.7 a	2225 a	75.2 abcdef	9.6 cdef	15.3 defgh	10.7 def	6.4 efghi	61.7 a
DE1002701A	94.7 a	2143 a	65.1 efgh	15.5 abcde	19.3 bcdefg	10.0 ef	6.8 defghi	70.0 a
<i>p-value</i>	0.1118	0.0919	0.0005	0.0295	0.0013	0.0004	0.0023	0.0925
Fisher's LSD³	NA	NA	11.049	10.134	12.709	6.9234	3.4277	NA
Tukey's HSD⁴	NA	NA	21.593	19.805	24.837	13.53	6.6984	61.359

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. * indicates averages of less than four replications not included in the statistical analysis.

⁴Minimum significant difference according to Tukey's HSD. *Table 6 continues on the next page.*

Table 6. Days to Harvest, Yield, Maturity at Harvest, Number of Pods per Plant, Plant Weight, and Percent Stand at Harvest, for Entries in the 2015 Fordhook Lima Bean Variety Trial *continued*

Variety ¹	Days to Harvest	Yield (Lbs/A)	% Full Pods	% Flat Pods	% Dry Pods	# Pods/Plant	Plant Weight (lbs/8 ft)	% Stand ²
DE1102205A	94.7 a	2105 a	71.8 bcdefg	16.3 abcd	12.0 efgh	12.2 cdef	7.4 defghi	68.3 a
DE1102303A	94.0 *	2015 *	72.1 *	10.2 *	17.7 *	11.8 *	6.3 *	55.0 *
DE0701301A	93.0 a	1983 a	71.0 bcdefg	7.4 cdef	21.5 bcdef	8.7 ef	7.1 defghi	80.0 a
DE1102401A	92.3 a	1869 a	58.7 h	12.5 bcdef	28.8 abc	8.4 ef	6.7 defghi	80.0 a
DE1102302A	96.0 a	1858 a	79.4 ab	9.6 cdef	11.1 efgh	9.2 ef	7.1 defghi	75.0 a
DE1002703B	93.0 a	1801 a	72.1 bcdefg	14.1 abcdef	13.8 defgh	10.1 ef	5.8 ghi	65.0 a
DE0804101A	95.0 a	1750 a	67.1 defgh	12.5 bcdef	20.4 bcdefg	5.9 f	8.1 bcdefghi	88.3 a
DE1102204E	98.0 a	1727 a	74.1 abcdef	9.3 cdef	16.6 cdefgh	10.9 def	6.0 fghi	65.0 a
DE1101604A	95.0 a	1664 a	70.5 bcdefg	6.9 def	22.6 bcde	18.0 abc	5.2 hi	31.7 a
DE1101502A	98.5 *	1524 *	58.7 *	29.3 *	12.0 *	13.3 *	7.4 *	60.0 *
DE0701303B	94.0 a	1366 a	64.5 fgh	23.6 a	12.0 efgh	11.5 cdef	4.9 i	46.7 a
DE1102209C	101.3 a	1323 a	79.2 ab	12.9 bcdef	7.9 gh	7.6 ef	5.5 ghi	70.0 a
DE1102202B	104.0 *	875 *	72.9 *	19.6 *	7.5 *	7.5 *	7.7 *	52.5 *
DE1101803A	100.0 *	555 *	69.8 *	18.6 *	11.6 *	7.5 *	3.6 *	20.0 *
<i>p-value</i>	0.1118	0.0919	0.0005	0.0295	0.0013	0.0004	0.0023	0.0925
Fisher's LSD³	NA	NA	11.049	10.134	12.709	6.9234	3.4277	NA
Tukey's HSD⁴	NA	NA	21.593	19.805	24.837	13.53	6.6984	61.359

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. * indicates averages of less than four replications not included in the statistical analysis.

⁴Minimum significant difference according to Tukey's HSD.

Table 7. Days to Harvest, Yield, 100 Seed Weight, % Acceptability from 2014 Quality Evaluation for Entries in the 2015 Fordhook Lima Bean Variety Trial

Variety	Days to Harvest	Yield (lbs/A)	100 Seed Wt (g)	% of Evaluators Rating as Acceptable
DE1102201A	96.7 a	3858 a	187 abcd	not evaluated
DE1002703A	92.7 a	3344 a	163 bcdefghij	100
DE1101902B	94.0 *	3278 *	138 *	not evaluated
DE0600602B	95.7 a	3079 a	209 a	16.7
DE1102209B	97.0 a	3036 a	188 abcd	not evaluated
DE1102104B	94.7 a	2976 a	193 ab	not evaluated
DE1102206A	98.5 *	2902 *	160 *	not evaluated
DE0900302A	93.3 a	2885 a	179 abcdefg	100
DE1102002A	99.0 a	2877 a	189 abc	not evaluated
DE0700904	96.3 a	2814 a	137 j	33.3
DE1102103C	95.0 *	2808 *	172 *	not evaluated
DE1102104C	95.7 a	2703 a	152 fghij	not evaluated
DE1102202A	97.0 *	2646 *	180 *	not evaluated
DE0803801B	93.7 a	2535 a	147 hij	0
DE1101503A	91.7 a	2530 a	169 bcdefghi	not evaluated
DE0701101	97.0 a	2481 a	186 abcd	0
DE0804404C	92.7 a	2467 a	165 bcdefghij	100
FH 242	95.0 a	2430 a	176 bcdefgh	16.7
DE1102209A	99.3 a	2402 a	166 bcdefghij	not evaluated
DE0803801A	93.0 a	2365 a	170 bcdefghi	16.7
DE0600605C	93.7 a	2225 a	175 bcdefgh	33.3
DE1002701A	94.7 a	2143 a	159 defghij	100
DE1102205A	94.7 a	2105 a	152 fghij	not evaluated
DE1102303A	94.0 *	2015 *	201 *	not evaluated
DE0701301A	93.0 a	1983 a	180 abcdefg	50
DE1102401A	92.3 a	1869 a	138 j	not evaluated
DE1102302A	96.0 a	1858 a	171 bcdefghi	not evaluated
DE1002703B	93.0 a	1801 a	162 cdefghij	80
DE0804101A	95.0 a	1750 a	151 ghij	16.7
DE1102204E	98.0 a	1727 a	155 efghij	not evaluated
DE1101604A	95.0 a	1664 a	183 abcde	not evaluated
DE1101502A	98.5 *	1524 *	192 *	not evaluated
DE0701303B	94.0 a	1366 a	141 ij	33.3
DE1102209C	101.3 a	1323 a	181 abcdef	not evaluated
DE1102202B	104.0 *	875 *	151 *	not evaluated
DE1101803A	100.0 *	555 *	159 *	not evaluated
<i>p-value</i>	0.1118	0.0919	0.0004	
Fisher's LSD¹	NA	NA	29.623	
Tukey's HSD²	NA	NA	57.890	

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

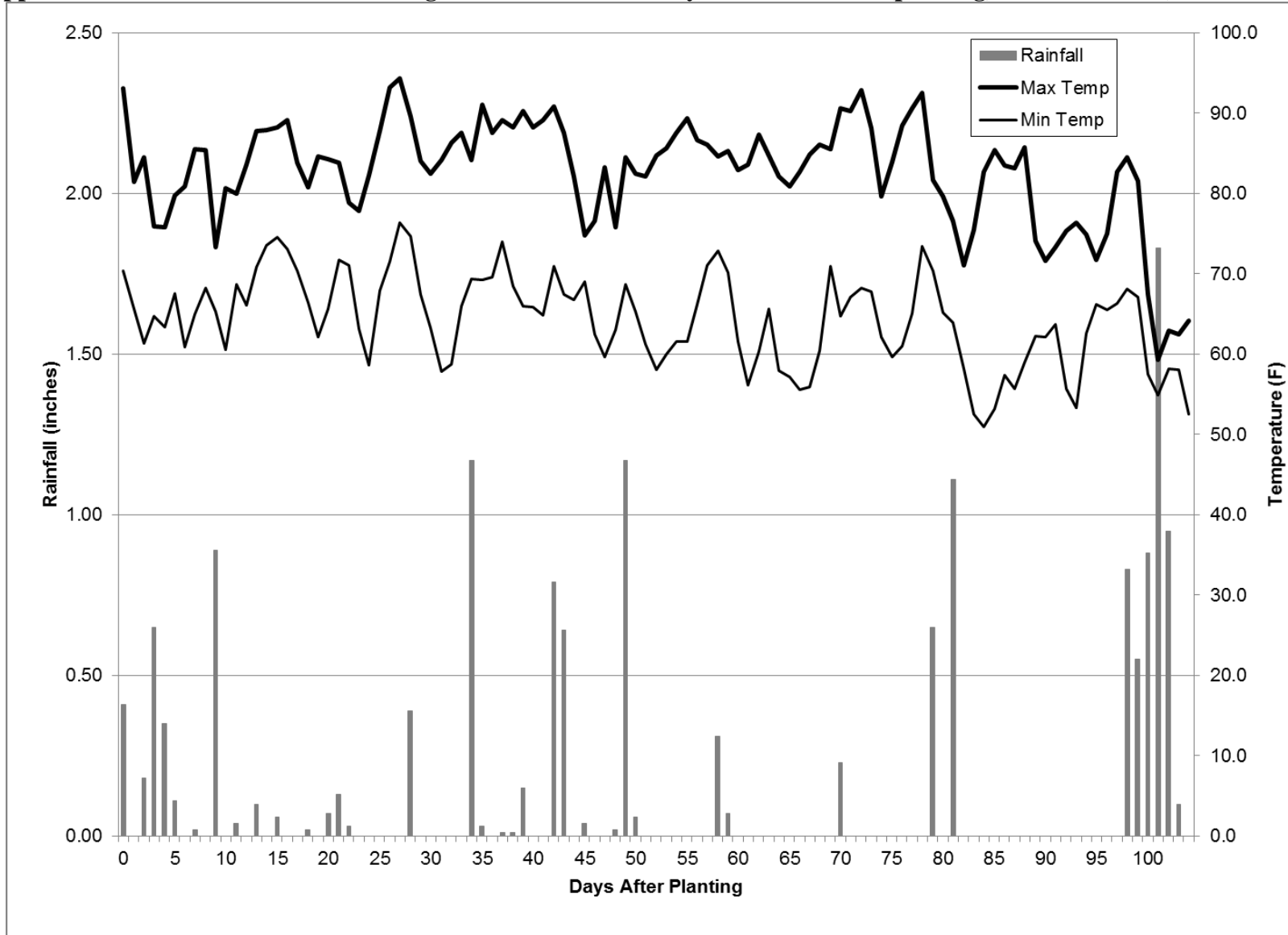
²Minimum significant difference according to Tukey's HSD.

**Appendix E: Weather Data for 2015 Fordhook Lima Variety Trial
June 23rd (planting) to October 5th (final harvest)**

DAP	Date	Max Temp °F	Min Temp °F	Rainfall (in.)
0	23-Jun	93.1	70.4	0.41
1	24-Jun	81.5	65.7	0
2	25-Jun	84.5	61.4	0.18
3	26-Jun	75.9	64.7	0.65
4	27-Jun	75.8	63.4	0.35
5	28-Jun	79.8	67.6	0.11
6	29-Jun	80.9	60.9	0
7	30-Jun	85.5	65	0.02
8	1-Jul	85.4	68.3	0
9	2-Jul	73.3	65.3	0.89
10	3-Jul	80.7	60.6	0
11	4-Jul	80	68.7	0.04
12	5-Jul	83.6	66.1	0
13	6-Jul	87.8	70.8	0.10
14	7-Jul	87.9	73.6	0
15	8-Jul	88.3	74.6	0.06
16	9-Jul	89.1	73.1	0
17	10-Jul	83.8	70.4	0
18	11-Jul	80.8	66.4	0.02
19	12-Jul	84.6	62.2	0
20	13-Jul	84.3	65.6	0.07
21	14-Jul	83.8	71.7	0.13
22	15-Jul	78.9	71.1	0.03
23	16-Jul	77.8	63.2	0
24	17-Jul	82.3	58.6	0
25	18-Jul	87.8	67.9	0
26	19-Jul	93.2	71.5	0
27	20-Jul	94.3	76.4	0
28	21-Jul	89.6	74.7	0.39
29	22-Jul	84.1	67.5	0
30	23-Jul	82.5	63.3	0
31	24-Jul	84.2	57.9	0
32	25-Jul	86.3	58.7	0
33	26-Jul	87.6	66	0
34	27-Jul	84.2	69.4	1.17
35	28-Jul	91.1	69.3	0.03
36	29-Jul	87.6	69.6	0
37	30-Jul	89.2	74	0.01
38	31-Jul	88.2	68.5	0.01
39	1-Aug	90.3	66	0.15
40	2-Aug	88.3	65.9	0
41	3-Aug	89.1	64.9	0
42	4-Aug	90.8	71	0.79
43	5-Aug	87.6	67.4	0.64
44	6-Aug	82.2	66.8	0
45	7-Aug	74.8	69	0.04
46	8-Aug	76.6	62.5	0
47	9-Aug	83.3	59.7	0
48	10-Aug	75.8	63.1	0.02
49	11-Aug	84.5	68.7	1.17
50	12-Aug	82.5	65.3	0.06
51	13-Aug	82.1	61.2	0
52	14-Aug	84.7	58.1	0
53	15-Aug	85.7	60	0

DAP	Date	Max Temp °F	Min Temp °F	Rainfall (in.)
54	16-Aug	87.6	61.6	0
55	17-Aug	89.4	61.6	0
56	18-Aug	86.7	66.2	0
57	19-Aug	86.1	71.1	0
58	20-Aug	84.6	72.9	0.31
59	21-Aug	85.3	70.2	0.07
60	22-Aug	82.9	61.6	0
61	23-Aug	83.6	56.2	0
62	24-Aug	87.3	60.3	0
63	25-Aug	84.7	65.7	0
64	26-Aug	82.2	58	0
65	27-Aug	80.9	57.2	0
66	28-Aug	82.7	55.6	0
67	29-Aug	84.9	55.9	0
68	30-Aug	86.1	60.4	0
69	31-Aug	85.5	71	0
70	1-Sep	90.6	64.7	0.23
71	2-Sep	90.3	67.1	0
72	3-Sep	92.9	68.2	0
73	4-Sep	88.1	67.8	0
74	5-Sep	79.7	62.2	0
75	6-Sep	84	59.7	0
76	7-Sep	88.5	61	0
77	8-Sep	90.6	65.1	0
78	9-Sep	92.5	73.4	0
79	10-Sep	81.7	70.4	0.65
80	11-Sep	79.7	65.2	0
81	12-Sep	76.6	63.9	1.11
82	13-Sep	71.1	58.2	0
83	14-Sep	75.5	52.5	0
84	15-Sep	82.7	51	0
85	16-Sep	85.4	53.2	0
86	17-Sep	83.5	57.4	0
87	18-Sep	83.2	55.7	0
88	19-Sep	85.8	59	0
89	20-Sep	74.1	62.3	0
90	21-Sep	71.6	62.2	0
91	22-Sep	73.3	63.7	0
92	23-Sep	75.4	55.7	0
93	24-Sep	76.4	53.3	0
94	25-Sep	74.9	62.6	0
95	26-Sep	71.7	66.2	0
96	27-Sep	75	65.5	0
97	28-Sep	82.7	66.3	0
98	29-Sep	84.5	68.1	0.83
99	30-Sep	81.6	67.1	0.55
100	1-Oct	67.4	57.5	0.88
101	2-Oct	59.3	54.9	1.83
102	3-Oct	62.9	58.2	0.95
103	4-Oct	62.5	58.1	0.10
104	5-Oct	64.2	52.5	0

Appendix F: Weather Conditions During 2015 Fordhook Variety Trial June 23rd (planting) to October 5th (final harvest)



Acknowledgements

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