

2021 University of Delaware Round and Flat Podded Snap Bean Variety Trials

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Introduction

The 2021 Snap Bean Variety Trials included twenty-eight round-podded varieties and eleven flat-podded varieties from five participating companies. Varieties in the trials are listed below. Round and flat podded varieties were planted in separate trials. The purpose of the trials was to evaluate varieties for yield, quality characteristics, and heat tolerance in a once-over harvest situation.

Round-Podded Varieties Tried in 2021

Name	Entering Company	Name	Entering Company
PV 857	Crites Seed	World Cup	Brotherton
Jaguar	Crites Seed	Cosmos	Brotherton
PV 958	Crites Seed	RR 2015	Pure Line
PV 907	Crites Seed	RR 1037	Pure Line
Silverado	Crites Seed	RR 1040	Pure Line
HMX 017-5722	HM Clause	PL 0008	Pure Line
Bridger	HM Clause	Dominator	Pure Line
Peary (HMC 017711)	HM Clause	Annihilator	Pure Line
Joliet (HMX 017-5756)	HM Clause	Affirmed	Seminis
HMC 016203	HM Clause	Sybaris	Seminis
HMX 016-4423	HM Clause	SVGF2074	Seminis
HM5101 (std)	HM Clause	SVGF2091	Seminis
Caprice (std)	HM Clause	SV1286GW	Seminis
Jackson	Brotherton	SVGG1312	Seminis

Flat-Podded Varieties Tried in 2021

Name	Entering Company	Name	Entering Company
Navajo	Crites Seed	RR 5001	Pure Line
Memphis	Crites Seed	RR 5005	Pure Line
Okeechobee	Crites Seed	Usambara	Seminis
Asya	Brotherton	Tapia	Seminis
BEX175	Brotherton	Solferina	Seminis
Wav 19	Pure Line		

Materials and Methods

Location

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

Cultural Practices

Flat Podded Trial Planted May 11, 2021

The trial of flat podded varieties was planted on May 11, 2021. Varieties were planted in single-row plots arranged in a randomized complete block design with four replications. Plots were 20 feet long. Border rows of the standard variety ‘Usambara’ were planted on the outside of the plot. The seeding rate was 4.6 seeds/foot, for an in-row spacing of 2.6 inches, ~80,000 seeds per acre. Between row spacing was 30 inches.

The field was fertilized with potassium before planting according to soil test results. An application of 1.25 pt/A Dual Magnum 17 gpa N SUL 33 (27-0-0-6S) (50 lbs/a of N) was made pre-emergence. Plots were sidedressed with 10 gpa N-SUL 33 (30 lb/A of N) on June 15. Additional hand weeding was done as necessary. Weed control in the trial was excellent. Mustang Max at 4 oz/A was applied on June 16 to control potato leafhopper.

Round Podded Trial Planted June 2, 2021

The first trial of round podded varieties was planted on June 2, 2021. Varieties were planted in single-row plots arranged in a randomized complete block design with four replications. Plots were 20 feet long. Border rows of the standard variety ‘Caprice’ were planted on the outside of the plot. The seeding rate was 5.15 seeds/foot, for an in-row spacing of 2.3 inches, ~90,000 seeds per acre. Between row spacing was 30 inches.

The field was fertilized with potassium before planting according to soil test results. An application of 1.25 pt/A Dual Magnum 17 gpa N SUL 33 (27-0-0-6S) (50 lbs/a of N) was made pre-emergence. Plots were sidedressed with 10 gpa N-SUL 33 (30 lb/A of N) on June 15. This trial was cultivated and additional hand weeding was done as necessary. Weed control in the trial was excellent. Mustang Max at 4 oz/A was applied on June 16 to control potato leafhopper.

Round Podded Trial Planted June 16, 2021

The second trial of round podded varieties was planted on June 16, 2021. Varieties were planted in single-row plots arranged in a randomized complete block design with four replications. Plots were 20 feet long. Border rows of the standard variety ‘Caprice’ were planted on the outside of the plot. The seeding rate was 5.15 seeds/foot, for an in-row spacing of 2.3 inches, ~90,000 seeds per acre. Between row spacing was 30 inches.

The field was fertilized with potassium before planting according to soil test results. An application of 1.25 pt/A Dual Magnum 17 gpa N SUL 33 (27-0-0-6S) (50 lbs/a of N) was made pre-emergence. Plots were sidedressed with 10 gpa N-SUL 33 (30 lb/A of N) on July 6. This trial was cultivated and additional hand weeding was done as necessary. Weed control in the trial was only moderate due to severe stand loss and poor plant growth. Mustang Max at 4 oz/A was applied on July 20 to control potato leafhopper and stinkbug.

All trials were overhead irrigated as necessary with a traveling linear system.

Harvest

Flat Podded Trial Harvest

To determine a variety’s maturity, ten plants were pulled from the plot and the most mature pod removed from each plant. The center seed from each of the ten pods was removed and lined up. A variety was

considered ready for harvest when the line of seeds measured 9-11.2 cm (i.e. average seed length of 9 to 11.2 mm). Seed length leading up to and including harvest for the trial is given in Table 10.

Harvest of the May 11-planted trial began on July 6 (56 DAP) and was completed on July 13 (63 DAP). Plants were pulled from a 10-foot section of each plot and all pods were removed by hand. All pods were weighed to determine yield and then a 1000 g sub-sample of pods was evaluated for quality based on the USDA standard and graded as U.S. Fancy, U.S. No. 1 or Cull. Pod length, pod width and length of the center seed was recorded for 10 marketable pods. Pod dimensions were measured with a ruler, seed length with digital calipers.

Round Podded Trial Harvest

Harvest of the June 2-planted trial began on July 22 (50 DAP) and was completed on July 30 (58 DAP). Emergence and stands were excellent or good for most varieties. At harvest, plants were pulled from a 10-foot section of each 20-foot plot and all pods were removed by hand. All pods were weighed to determine yield and then a 300 g sub-sample of pods was evaluated for quality based on the USDA standard and graded as U.S. Fancy, U.S. No. 1 or Cull. Fancy and No. 1 grade beans were considered marketable and were further graded by diameter sieve size. The beans in each quality and size grade were weighed. Pod length and seed length was recorded for 10 marketable grade pods.

Harvest of the June 16-planted trial began on August 13 (58 DAP) and was completed on August 20 (65 DAP). Harvest procedures were the same as for the June 2-planted trial.

Results

Round Podded Trials

Yields from the two round podded trials are reported separately in Tables 1 and 2. Figure 1 shows marketable and cull yields from both trials. The percent of yield in each quality grade is reported in Tables 3 and 4. Tables 5 and 6 report the percent of marketable pods in each sieve size. Table 7 reports the pod length for each variety for both trials. Table 8 reports the seed length of marketable pods for both trials. Table 9 reports plant height and width for both trials.

Figures 2 and 3 are charts showing high and low temperatures and rainfall for each trial.

Flat Podded Trial

For flat podded varieties, seed length measurements to determine maturity, up to and including harvest is reported in Table 10. Yields from the flat podded trial are reported in Table 11 and Figure 4 is a chart of total of marketable yield for each variety. The percent of pods in each quality grade is reported in Table 12. Pod length and width are reported in Table 13. Plant height and width are reported in Table 14.

Figure 5 is a chart showing high and low temperatures and rainfall for each trial.

Discussion

Round Podded Trials

The first round podded trial (Jun 2) had good emergence and stand establishment for most varieties. There were significant differences in percent stand among the varieties (Table 1), however total yield was not strongly correlated with percent stand (R^2 value =0.19). Plants in this trial grew well and nearly filled the row middles (Table 7) with an average height of 41 cm and average width of 50 cm. Weeds were well controlled. The first round podded trial experienced moderate heat stress during the early flowering period (25-34 DAP) with an average night temperature of 68 °F. Six nights in that time period were above 68 °F, which is considered the threshold for damage to pollen and anther development, and four were below.

The varieties with the highest marketable yield in the first round-podded trial were Bridger, PV 857 and Jaguar. Bridger and PV 857 have performed well in previous trials that were exposed to heat stress. Jaguar was trialed for the first time in 2021 and may have some heat tolerance. In addition to the three top yielding varieties the following seven varieties had significantly higher marketable yields than the standard variety Caprice: HMX 017-5722, Cosmos, PL 0008, RR 1037, Dominator, PV 958 and Annihilator.

The second round podded trial (Jun 16) had good emergence but some seedlings succumbed to root disease following a rainy period 22 and 23 days after planting (Fig. 3). Pythium was isolated from roots of affected plants. Stand loss was more significant in two of the four replications where the soil became more waterlogged. Because of stand loss and slow growth weeds were only moderately well controlled in this plot. There are statistically significant differences in stand between the varieties (Table 2), indicating that some varieties were better able to tolerate the root stress. Total yield was correlated with percent stand (R^2 value =0.59). Additionally, plants were smaller in this trial and did not fill the row middles (Table 9). Average height was 33 cm and average width was 29 cm. Flowering was delayed because of root stress and the early flowering period for this trial coincided with a cooler temperature period from 32-41 DAP. In this timeframe the average night temperature was 67 °F and five out of ten days were above the threshold temperature of 68 °F. This trial did not experience as much heat stress during flowering as the Jun 2 round podded trial.

The variety with the highest marketable yield in the second round podded trial was HMX 017-5722. This variety had significantly higher yields than every other variety in the trial (Table 2). In addition to this variety, the following varieties had significantly higher marketable yields than the standard variety Caprice: PL 0008, Peary, Bridger, Joliet, HMX 016-4423, PV 907 and Jaguar.

Varieties with high yields in both trials are HMX 017-5722 (Byrd), Bridger, PL 0008 and Jaguar.

Flat Podded Trial

The flat podded trial (May 11) had good emergence and stand establishment. Although there were significant differences in stand among the varieties (Table 11) percent stand was not correlated with total yield ($R^2=0.08$). Plants grew to a moderate size with an average height of 47 cm and average width of 41 cm but did not fully fill the rows. Mid-May planted snap beans often have a smaller plant size than later planting dates. Despite not filling the rows, weed control was excellent in this plot. Full flower occurred around 42 DAP and this trial experienced moderate heat stress. The average night temperature for the early flowering period (33-42 DAP) was 67 °F with five days in that timeframe having night temperatures above the 68 °F threshold and five nights below it.

The varieties with the highest marketable yields in the trial were BEX175, Solferina and Tapia (Table 11, Fig. 4). Usambara had significantly higher total yield than all other varieties but had a high percent of culls. The large number of culls may be because this variety was picked slightly early (see average seed length).

Usambara and Tapia also performed well in trials conducted in 2019.

There were statistically significant differences in pod length and width (Table 13). Wav19 produced significantly longer pods than all other varieties and RR 5001 produced significantly shorter pods than all other varieties. Navajo, Usambara and Wav 19 produced the widest pods and Asaya, RR 5005 and BEX175 produced the narrowest pods.

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Table 1. June 2 Planted Trial: Days to Harvest, % Stand; Total, Marketable, Fancy, No.1 and Cull Yield in Pounds Per Acre; Seed Length

Variety	Days to Harvest	% Stand	Total Yield (lbs/ acre)	Marketable Yield (lbs/acre)	Fancy Yield (lbs/acre)	No. 1 Yield (lbs/acre)	Cull Yield (lbs/acre)	Seed Length (mm)
Bridger	50.3 h	90.9 abc	7,998 ab	6,085 a	521 cd	5,564 a	1,913 fghijkl	8.59 defg
PV 857	50.0 h	96.2 a	8,470 ab	5,664 ab	1338 a	4,326 ab	2,806 cdefg	8.47 efgh
Jaguar	51.0 gh	92.8 ab	6,760 bcde	4,984 abc	1011 ab	3,974 bc	1,775 fghijkl	7.60 hi
HMX017-5722	54.3 de	96.2 a	9,149 a	4,383 bcd	0 f	4,383 ab	4,767 a	10.04 abc
Cosmos	50.8 h	74.5 cdefg	5,358 defg	4,144 bcde	288 def	3,856 bcd	1,214 jkl	5.80 k
PL 0008	52.5 f	81.7 abcdef	7,216 abcd	3,967 cde	326 def	3,641 bcde	3,249 bcde	8.03 fghi
RR 1037	52.3 fg	65.9 fg	5,219 efgh	3,789 cdef	391 cdef	3,398 bcdef	1,430 ijkl	8.30 efgh
Dominator	50.8 h	69.7 defg	5,034 efgh	3,359 defg	448 cde	2,911 bcdefgh	1,675 ghijkl	8.55 defgh
PV 958	54.5 de	90.4 abc	7,335 abc	3,293 defgh	76 ef	3,217 bcdefg	4,042 ab	10.63 a
Annihilator	50.5 h	73.6 cdefg	4,545 fghi	3,252 defghi	775 bc	2,478 defghij	1,292 jkl	7.86 fghi
RR 2015	53.3 ef	84.1 abcde	4,770 fghi	2,947 defghij	58 ef	2,888 bcdefgh	1,824 fghijkl	7.19 ij
Silverado	54.3 de	88.5 abc	4,568 fghi	2,786 efghijk	137 def	2,649 cdefghi	1,782 fghijkl	8.38 efgh
Joliet	53.3 ef	99.0 a	5,019 efgh	2,785 efghijk	246 def	2,539 cdefghi	2,234 defghijk	9.17 cde
HMC 016203	54.3 de	73.6 cdefg	4,453 fghi	2,334 fghijkl	0 f	2,334 efghij	2,120 efghijk	10.15 ab
SVGF2091	55.3 bcd	76.9 bcdefg	4,367 fghi	2,106 ghijkl	94 def	2,013 fghijk	2,261 defghij	7.77 ghi
RR 1040	52.8 f	60.1 g	3,708 fghij	1,996 ghijklm	78 ef	1,918 fghijkl	1,712 fghijkl	8.41 efgh
Affirmed	56.0 abc	84.1 abcde	4,798 fghi	1,914 ghijklm	0 f	1,914 fghijkl	2,884 bcdef	7.26 ij
Peary	55.0 cd	94.2 ab	5,191 efgh	1,802 hijklmn	0 f	1,802 ghijkl	3,389 bcd	10.20 ab
PV 907	55.3 bcd	86.1 abcd	3,354 hijk	1,758 hijklmn	36 ef	1,722 hijklm	1,596 hijkl	7.73 ghi
HM5101 (std)	55.0 cd	64.4 fg	4,308 fghi	1,724 ijklmn	0 f	1,724 ghijklm	2,585 defghi	9.51 bcd
HMX016-4423	54.8 cd	96.6 a	5,503 cefg	1,699 ijklmn	0 f	1,699 hijklm	3,804 abc	8.83 def
SV1286GW	54.5 de	88.0 abc	3,517 ghijk	1,696 jklmn	116 def	1,581 hijklm	1,820 fghijkl	6.56 jk
Caprice (std)	55.3 bcd	93.8 ab	4,132 fghi	1,498 jklmn	0 f	1,498 hijklm	2,635 cdefgh	8.50 efgh
World Cup	56.0 abc	88.9 abc	2,980 ijkl	1,285 klmn	0 f	1,285 ijklm	1,695 ghijkl	10.12 abc
Sybaris	56.8 a	84.6 abcde	3,381 hijk	998 lmn	0 f	998 jklm	2,383 defghij	8.10 fghi
Jackson	55.3 bcd	68.3 efg	1,891 jkl	823 lmn	20 ef	802 klm	1,068 kl	7.13 ij
SVGF2074	56.5 ab	64.9 fg	1,753 kl	500 mn	0 f	500 lm	1,253 jkl	8.38 efgh
SVGG1312	57.0 a	87.0 abcd	1,090 l	304 n	0 f	304 m	786 l	8.19 ²
p-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Fisher's LSD¹	1.5	17.7	1949	1553	442	1494.8	1176	0.98
C.V.	1.98	15.23	28.55	41.85	147.53	43.9	37.81	26.07

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

²Average of two replications.

Table 2. June 16 Planted Trial: Days to Harvest, % Stand; Total, Marketable, Fancy, No.1 and Cull Yield in Pounds Per Acre; Seed Length

Variety	Days to Harvest	% Stand	Total Yield (lbs/ acre)	Marketable Yield (lbs/acre)	Fancy Yield (lbs/acre)	No. 1 Yield (lbs/acre)	Cull Yield (lbs/acre)	Seed Length (mm)
HMX017-5722	58.0 g	87.5 a	8,835 a	7,346 a	3,975 a	3,371 a	1,489 bcd	7.37 fghijk
PL 0008	62.5 bc	53.8 cde	7,805 ab	5,215 b	2,676 abcdef	2,539 b	2,590 a	10.36 a
Peary	61.8 cd	72.6 abc	6,880 abc	5,165 b	2,880 abcd	2,286 bc	1,714 ab	7.13 hijk
Bridger	60.3 def	72.1 abc	6,441 bcd	4,885 bc	3,207 abc	1,679 cde	1,556 bc	8.69 c
Joliet	58.8 fg	80.3 a	5,920 bcde	4,539 bcd	3,360 ab	1,179 defghij	1,381 bcde	7.01 jk
HMX016-4423	59.5 efg	76.9 ab	5,152 cdef	4,306 bcde	2,631 abcdefg	1,675 cde	846 bcdefg	7.71 efghij
PV 907	64.5 ab	59.6 bcd	5,150 cdef	4,290 bcde	2,383 bcdefgh	1,907 bcd	860 bcdefg	6.15 l
Jaguar	64.5 ab	53.4 cdef	5,005 cdefg	4,085 bcdef	2,788 abcde	1,297 defghi	921 bcdefg	9.56 b
SV1286GW	64.3 ab	72.1 abc	4,969 cdefg	3,785 bcdefg	2,233 bcdefghi	1,552 cdefg	1,184 bcdef	6.72 kl
RR 1040	59.5 efg	34.6 efgh	4,484 defg	4,130 bcdef	2,581 abcdefg	1,550 cdefg	354 fg	8.29 cde
SVGF2091	64.5 ab	48.6 defg	4,150 defgh	3,309 bcdefgh	1,927 bcdefghijk	1,382 defghi	841 bcdefg	7.82 efgh
Affirmed	64.5 ab	41.3 defgh	4,112 defgh	3,146 cdefghij	1,479 defghijk	1,666 cdef	967 bcdefg	6.79 kl
Dominator	60.3 def	33.2 gh	3,896 efghi	3,285 bcdefgh	2,481 abcdefgh	804 ghij	612 defg	8.68 c
PV 958	59.5 efg	50.0 defg	3,834 efghi	3,214 cdefgh	1,917 bcdefghijk	1,297 defghi	620 defg	7.92 defg
Cosmos	61.0 cde	45.7 defg	3,674 efghi	3,007 cdefghij	1,883 bcdefghijk	1,125 defghij	667 cdefg	7.83 efgh
Annihilator	60.3 def	33.2 gh	3,339 fghi	2,904 defghij	2,061 bcdefghij	842 fghij	435 fg	7.76 efghi
HMC 016203	61.8 cd	32.7 gh	3,330 fghi	3,010 cdefghij	2,297 bcdefgh	713 hij	320 fg	8.55 cd
HM5101 (std)	60.3 def	48.6 defg	3,298 fghi	2,904 defghij	1,652 cdefghijk	1,252 defghi	394 fg	7.71 efghij
SVGG1312	64.5 ab	31.3 gh	3,295 fghi	1,876 ghij	477 jk	1,399 defgh	1,419 bcde	7.04 jk
World Cup	61.8 cd	42.3 defg	3,287 fghi	2,417 efghij	1,169 fghijk	1,248 defghi	870 bcdefg	7.37 fghijk
SVGF2074	62.5 bc	34.1 fgh	3,203 fghi	2,778 defghij	1,461 defghijk	1,317 defghi	425 fg	7.97 def
PV 857	58.0 g	58.7 bcd	3,134 fghi	2,299 fghij	1,340 defghijk	959 efghij	834 bcdefg	8.31 cde
Caprice (std)	59.5 efg	59.6 bcd	2,731 ghi	1,913 ghij	1,060 ghijk	853 efghij	818 bcdefg	7.25 ghijk
RR 2015	59.5 efg	48.6 defg	2,642 ghi	2,105 ghij	989 hijk	1,116 defghij	537 efg	7.26 fghijk
Sybaris	64.3 ab	22.1 h	2,032 hi	1,712 hij	706 ijk	1,006 efghij	320 fg	7.20 hijk
Jackson	65.0 a	34.6 efgh	1,865 hi	1,291 ij	456 k	835 ghij	574 defg	7.06 ijk
Silverado	62.5 bc	31.3 gh	1,823 hi	1,609 hij	1,257 efghijk	351 j	214 g	7.04 jk
RR 1037	58.8 fg	22.1 h	1,560 i	1,225 j	658 ijk	567 ij	335 fg	6.88 k
<i>p-value</i>	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
<i>Fisher's LSD¹</i>	2.01	19.3	2390	1934	1587	828	922	0.71
<i>C.V.</i>	2.32	27.8	41.05	41.94	58.5	43.7	76.1	21.0

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

²Average of two replications.

Table 3. June 2 Planted Trial: Percent of Yield in Each Quality Grade

Variety	% Marketable	% Fancy	% No. 1
Cosmos	76.9 a	4.5 bcd	72.4 a
Bridger	75.9 a	6.4 bc	69.5 ab
Jaguar	73.5 ab	15.0 a	58.5 abcde
Annihilator	69.4 abc	14.3 a	55.2 bcdef
PV 857	66.7 abcd	15.2 a	51.6 cdefg
RR 1037	66.4 abcd	5.9 bc	60.6 abc
RR 2015	62.2 abcde	2.2 bcd	60.0 abcd
Dominator	62.2 abcde	7.4 b	54.8 bcdef
RR 1040	58.5 bcdef	3.6 bcd	54.9 bcdef
Silverado	54.1 cdefg	2.3 bcd	51.8 cdefg
HMC 016203	53.7 cdefgh	0.0 d	53.7 bcdefg
PL 0008	52.2 defgh	4.3 bcd	47.8 cdefgh
Joliet	51.6 defgh	3.8 bcd	47.8 cdefgh
PV 907	50.1 defghi	1.0 cd	49.1 cdefgh
HMX 017-5722	46.8 efghi	0.0 d	46.8 cdefgh
SV1286GW	45.4 efghij	3.1 bcd	42.3 efghi
SVGF2091	45.1 fghij	1.7 bcd	43.4 defghi
PV 958	45.0 fghij	1.0 cd	44.0 cdefghi
Jackson	41.9 fghijk	0.9 cd	41.0 fghi
World Cup	41.3 ghijk	0.0 d	41.3 fghi
HM5101 (std)	36.8 hijkl	0.0 d	36.8 ghij
Caprice (std)	34.3 ijkl	0.0 d	34.3 hij
Affirmed	34.0 ijklm	0.0 d	34.0 hijk
Peary	33.7 ijklm	0.0 d	33.7 hijk
HMX 016-4423	29.7 jklm	0.0 d	29.7 ijk
Sybaris	27.1 klm	0.0 d	27.1 ijk
SVGF2074	22.4 lm	0.0 d	22.4 jk
SVGG1312	17.0 m	0.0 d	17.0 k
<i>p-value</i>	<i><0.0001</i>	<i><0.0001</i>	<i><0.0001</i>
Fisher's LSD¹	17.11	5.75	17.06
Coefficient of Variation	24.8	123.9	26.5

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

Table 4. June 16 Planted Trial: Percent of Yield in Each Quality Grade

Variety	% Marketable	% Fancy	% No. 1
RR 1040	92.0 a	58.2 abc	33.7 a
Silverado	90.1 ab	65.8 a	24.3 a
SVGF2074	88.2 abc	41.7 cdef	46.6 a
Dominator	87.9 abc	61.4 ab	26.5 a
Annihilator	87.3 abcd	61.2 ab	26.1 a
HM5101 (std)	86.1 abcde	49.2 abcde	36.9 a
HMX 017-5722	84.3 abcdef	45.8 bcde	38.4 a
Jaguar	83.4 abcdefg	57.7 abc	25.7 a
HMC 016203	83.3 abcdefg	51.7 abcd	31.6 a
HMX 016-4423	82.8 abcdefg	50.4 abcd	32.4 a
Cosmos	81.5 abcdefg	49.2 abcde	32.4 a
PV 958	81.3 abcdefg	49.0 bcde	32.3 a
PV 907	81.1 abcdefg	43.7 cde	37.3 a
Sybaris	80.2 abcdefg	37.6 def	42.5 a
SVGF2091	79.8 abcdefg	47.9 bcde	31.9 a
RR 1037	79.4 abcdefg	42.3 cde	37.1 a
RR 2015	79.1 abcdefg	36.9 def	42.2 a
Joliet	78.3 abcdefgh	57.7 abc	20.5 a
Bridger	77.1 bcdefgh	50.0 abcd	27.2 a
Peary	75.3 cdefgh	40.5 def	34.8 a
World Cup	73.5 defgh	36.2 def	37.3 a
PV 857	73.2 efgh	43.7 cde	29.6 a
Affirmed	73.1 efgh	33.3 ef	39.8 a
PL 0008	72.0 fgh	39.7 def	32.3 a
SV1286GW	71.2 fgh	40.8 def	30.4 a
Caprice (std)	69.9 ghi	37.0 def	32.9 a
Jackson	65.1 hi	25.3 fg	39.8 a
SVGG1312	56.6 i	14.7 g	41.9 a
<i>p-value</i>	<i>0.0008</i>	<i><0.0001</i>	<i>0.1167</i>
Fisher's LSD¹	13.99	16.62	NA
Coefficient of Variation	12.6	26.1	31.0

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

Table 5. June 2 Planted Trial: Varieties by Percent of Marketable Pods in Each Diameter Size Grade

Variety	% Grade 2	% Grade 3	% Grade 4	% Grade 5	% Grade 6	Seed Length (mm)
SV1286GW	0.5 a	44.5 a	18.5 a	36.8 f	0.0 a	6.56 jk
PV 857	3.8 a	29.3 b	30.5 a	36.8 f	0.0 a	8.47 efgh
Cosmos	0.5 a	27.0 b	7.0 a	65.5 bcdef	0.0 a	5.80 k
Jaguar	0.0 a	23.5 bc	32.0 a	44.8 ef	0.0 a	7.60 hi
RR 1037	0.0 a	16.3 bcd	26.5 a	57.3 cdef	0.0 a	8.30 efgh
Annihilator	0.0 a	11.3 cde	37.0 a	51.8 def	0.0 a	7.86 fghi
RR 1040	0.0 a	10.0 cde	25.0 a	65.0 bcdef	0.0 a	8.41 efgh
Bridger	0.8 a	5.0 de	16.0 a	78.3 abcd	0.0 a	8.59 defg
PL 0008	0.0 a	4.3 de	0.0 a	95.8 ab	0.0 a	8.03 fghi
Dominator	0.5 a	4.3 de	29.8 a	65.3 bcdef	0.0 a	8.55 defgh
HMX 016-4423	0.0 a	3.3 de	54.8 a	42.3 f	0.0 a	8.83 def
Joliet	0.0 a	3.0 de	15.8 a	81.0 abcd	0.0 a	9.17 cde
PV 958	0.0 a	2.3 de	20.0 a	77.8 abcde	0.0 a	10.63 a
HMX 017-5722	0.0 a	2.3 de	3.5 a	94.3 ab	0.0 a	10.04 abc
Affirmed	0.0 a	1.3 e	37.8 a	61.0 cdef	0.0 a	7.26 ij
RR 2015	0.0 a	1.0 e	16.0 a	83.3 abcd	0.0 a	7.19 ij
PV 907	0.8 a	0.8 e	10.5 a	88.5 abc	0.0 a	7.73 ghi
Silverado	0.0 a	0.0 e	5.3 a	94.8 ab	0.0 a	8.38 efgh
Peary	0.0 a	0.0 e	24.3 a	75.8 abcde	0.0 a	10.20 ab
HMC 016203	0.0 a	0.0 e	0.0 a	100.0 a	0.0 a	10.15 ab
HM5101 (std)	0.0 a	0.0 e	11.3 a	88.8 abc	0.0 a	9.51 bcd
Caprice (std)	0.0 a	0.0 e	17.3 a	82.8 abcd	0.0 a	8.50 efgh
Jackson	0.0 a	0.0 e	12.8 a	87.3 abc	0.0 a	7.13 ij
World Cup	0.8 a	0.0 e	0.0 a	99.3 a	0.0 a	10.12 abc
Sybaris	0.0 a	0.0 e	9.8 a	90.3 abc	0.0 a	8.10 fghi
SVGF2074	0.0 a	0.0 e	21.7 a	78.3 abcd	0.0 a	8.38 efgh
SVGF2091	0.0 a	0.0 e	22.3 a	77.8 abcde	0.0 a	7.77 ghi
SVGG1312	0.0 *	0.0 *	10.0 *	90.0 *	0.0	8.19 *
<i>p-value</i>	0.0561	<0.0001	0.0745	0.0004	<i>NA</i>	<0.0001
<i>Fisher's LSD¹</i>	<i>NA</i>	14.42	<i>NA</i>	33.1	<i>NA</i>	0.98
<i>C.V.</i>	417.8	144.1	112.7	31.6	<i>NA</i>	26.1

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

*Average of 2 reps

Table 6. June 16 Planted Trial: Varieties by Percent of Marketable Pods in Each Diameter Size Grade

Variety	% Grade 2	% Grade 3	% Grade 4	% Grade 5	% Grade 6	Seed Length (mm)
SV1286GW	13.0 a	83.8 a	3.3 i	0.0 k	0.0 e	6.72 kl
HMX 017-5722	2.8 cde	41.0 b	40.3 abcdef	16.3 ijk	0.0 e	7.37 fghijk
PV 958	4.8 bcd	35.8 bc	43.0 abcde	16.8 hijk	0.0 e	7.92 defg
SVGF2091	3.8 cde	34.5 bcd	46.0 abcd	15.5 jk	0.0 e	7.82 efgh
HM5101 (std)	4.3 cde	24.5 bcde	33.3 bcdefgh	31.8 defghij	7.0 cde	7.71 efghij
SVGG1312	0.8 de	24.5 bcde	49.5 ab	25.3 fghij	0.0 e	7.04 jk
RR 1037	6.3 bc	23.0 cde	41.8 abcde	27.5 efghij	1.5 de	6.88 k
Jaguar	1.5 de	22.8 cde	54.8 a	20.8 ghij	0.0 e	9.56 b
Sybaris	2.3 cde	22.3 cdef	54.5 a	21.3 ghij	0.0 e	7.20 hijk
Silverado	3.0 cde	21.3 cdef	30.3 cdefgh	45.5 abc	0.0 e	7.04 jk
Caprice (std)	4.3 cde	20.0 cdef	41.3 abcde	34.8 cdefg	0.0 e	7.25 ghijk
Jackson	1.5 de	20.0 cdef	46.8 abc	32.0 defghij	0.0 e	7.06 ijk
Peary	3.5 cde	19.8 cdef	45.8 abcd	31.3 defghij	0.0 e	7.13 hijk
RR 2015	1.0 de	19.5 cdef	31.8 cdefgh	35.0 cdefg	12.5 abcde	7.26 fghijk
Bridger	0.8 de	19.0 cdef	20.3 h	34.0 cdefghi	25.5 ab	8.69 c
SVGF2074	1.0 de	18.5 def	52.3 a	16.0 jk	12.3 abcde	7.97 def
World Cup	2.3 de	18.3 def	42.0 abcde	35.5 bcdefg	2.3 cde	7.37 fghijk
Joliet	4.8 bcd	18.0 def	44.3 abcde	32.8 defghij	0.0 e	7.01 jk
PV 857	8.8 ab	17.5 ef	29.8 defgh	26.0 fghij	17.8 abcde	8.31 cde
Dominator	0.8 de	17.0 ef	21.5 h	44.8 abcde	16.0 abcde	8.68 c
Cosmos	1.0 de	14.5 ef	24.0 fgh	34.3 cdefgh	26.0 a	7.83 efgh
HMX 016-4423	1.0 de	14.3 ef	31.8 cdefgh	45.3 abcde	8.0 bcde	7.71 efghij
HMC 016203	1.8 de	11.3 ef	21.0 h	40.5 abcdef	25.8 ab	8.55 cd
PV 907	0.0 e	9.8 ef	34.8 bcdefgh	53.3 ab	2.3 cde	6.15 l
PL 0008	0.5 de	9.5 ef	23.0 gh	51.3 abc	15.5 abcde	10.36 a
Annihilator	2.5 cde	9.0 ef	38.8 abcdefg	30.5 defghij	19.8 abc	7.76 efghi
RR 1040	3.0 cde	8.8 ef	28.5 efgh	41.8 abcdef	18.3 abcd	8.29 cde
Affirmed	0.5 de	5.8 f	35.5 bcdefgh	55.5 a	3.3 cde	6.79 kl
<i>p-value</i>	<0.0001	<0.0001	<0.0001	<0.0001	0.0043	<0.0001
<i>Fisher's LSD¹</i>	4.41	16.79	16.72	17.99	17.81	0.71
<i>C.V.</i>	108.4	55.4	33.0	40.0	166.0	21.0

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

Table 7. Pod Length in Centimeters of Marketable Pods for Both Trials and Overall Average

Variety	Jun 2 Trial Pod Length (cm)	Jun 16 Trial Pod Length (cm)	Overall Average Pod Length (cm)
HMX 017-5722	13.3 bcd	13.7 ab	13.5
SVGF2091	13.6 ab	13.3 abcdef	13.5
Silverado	13.9 a	13.1 cdefghi	13.5
Bridger	13.3 abc	13.6 abc	13.4
HMC 016203	13.7 ab	12.9 defghij	13.3
PV 907	12.6 efgh	13.9 a	13.2
Jackson	13.4 ab	13.0 cdefghij	13.2
Affirmed	12.6 efgh	13.7 ab	13.1
Joliet	12.3 efghi	13.7 ab	13.0
PV 958	12.7 ef	13.2 bcdefgh	12.9
World Cup	12.7 efg	13.0 cdefghi	12.9
Sybaris	12.7 def	12.8 fghij	12.8
HM5101 (std)	12.7 def	12.7 ghij	12.7
Annihilator	12.4 efghi	13.0 cdefghij	12.7
PL 0008	12.1 ghi	13.2 bcdefg	12.7
Dominator	11.9 ij	13.4 abcde	12.6
RR 1037	12.4 efghi	12.9 efghij	12.6
Cosmos	12.2 fghi	12.8 efghij	12.5
Peary	12.3 efghi	12.6 hijk	12.5
RR 2015	12.3 efghi	12.7 ghij	12.5
Jaguar	12.8 cde	12.1 kl	12.4
PV 857	11.4 j	13.5 abcd	12.4
SVGF2074	11.8 ij	12.9 defghij	12.4
Caprice (std)	12.1 ghi	12.5 ijk	12.3
HMX 016-4423	12.0 hi	12.4 jk	12.2
RR 1040	11.3 j	12.9 defghij	12.1
SV1286GW	11.5 j	11.7 lm	11.6
SVGG1312	11.8 *	11.3 m	11.5
<i>p-value</i>	<i><0.0001</i>	<i><0.0001</i>	
Fisher's LSD¹	<i>0.568</i>	<i>0.579</i>	
C.V.	<i>10.19</i>	<i>10.2</i>	

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

*Average of 2 reps

Table 8. Seed Length in Millimeters from Marketable Pods for Both Trials and Overall Average

Variety	Jun 2 Trial Seed Length (mm)	Jun 16 Trial Seed Length (mm)	Overall Average Seed Length (mm)
HMC 016203	10.15 ab	8.55 cd	9.3
PV 958	10.63 a	7.92 defg	9.3
PL 0008	8.03 fghi	10.36 a	9.2
World Cup	10.12 abc	7.37 fghijk	8.7
HMX 017-5722	10.04 abc	7.37 fghijk	8.7
Peary	10.20 ab	7.13 hijk	8.7
Bridger	8.59 defg	8.69 c	8.6
Dominator	8.55 defgh	8.68 c	8.6
HM5101 (std)	9.51 bcd	7.71 efghij	8.6
Jaguar	7.60 hi	9.56 b	8.6
PV 857	8.47 efgh	8.31 cde	8.4
RR 1040	8.41 efgh	8.29 cde	8.3
HMX 016-4423	8.83 def	7.71 efghij	8.3
SVGF2074	8.38 efgh	7.97 def	8.2
Joliet	9.17 cde	7.01 jk	8.1
Caprice (std)	8.50 efgh	7.25 ghijk	7.9
Annihilator	7.86 fghi	7.76 efghi	7.8
SVGF2091	7.77 ghi	7.82 efgh	7.8
Silverado	8.38 efgh	7.04 jk	7.7
Sybaris	8.10 fghi	7.20 hijk	7.6
SVGG1312	8.19 *	7.04 jk	7.6
RR 1037	8.30 efgh	6.88 k	7.6
RR 2015	7.19 ij	7.26 fghijk	7.2
Jackson	7.13 ij	7.06 ijk	7.1
Affirmed	7.26 ij	6.79 kl	7.0
PV 907	7.73 ghi	6.15 l	6.9
Cosmos	5.80 k	7.83 efgh	6.8
<i>p-value</i>	<i><0.0001</i>	<i><0.0001</i>	
Fisher's LSD¹	0.98	0.71	
C.V.	26.07	20.98	

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

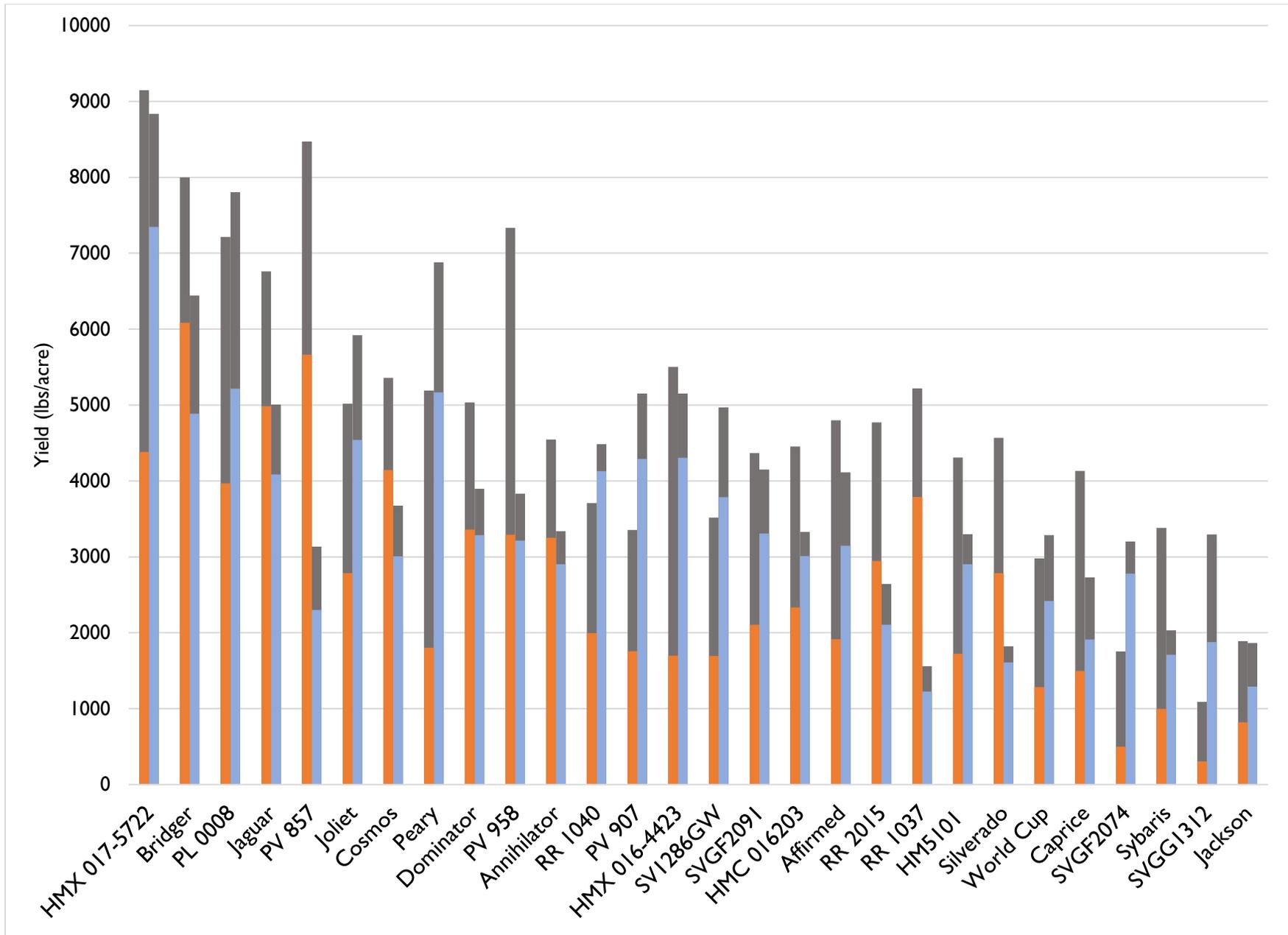
*Average of 2 reps

Table 9. Plant Height and Width in Centimeters for Both Round Podded Trials and Overall Average

Variety	Jun 2 Trial		Jun 16 Trial		Overall	
	Height (cm)	Width (cm)	Height (cm)	Width (cm)	Height	Width
Peary	45.8 ab	49.0 a	42.0 a	40.3 a	43.9	44.6
World Cup	41.0 abcd	56.5 a	39.0 bc	36.0 b	40.0	46.3
RR 2015	44.0 abc	67.0 a	30.3 jkl	30.5 de	37.1	48.8
HMX 017-5722	42.8 abcd	45.5 a	41.0 ab	38.5 a	41.9	42.0
Silverado	46.8 a	53.0 a	36.0 def	26.8 gh	41.4	39.9
SVGF2091	39.8 bcdef	56.8 a	36.0 def	30.0 de	37.9	43.4
HMX 016-4423	44.3 abc	54.3 a	32.5 ghij	30.0 de	38.4	42.1
Cosmos	42.0 abcd	59.8 a	30.3 jkl	28.8 efg	36.1	44.3
PV 907	40.8 abcd	51.8 a	36.0 def	29.8 de	38.4	40.8
PL 0008	40.3 bcde	50.3 a	35.8 def	30.0 de	38.0	40.1
RR 1037	34.3 ef	49.8 a	38.0 cd	33.5 c	36.1	41.6
Dominator	39.0 cdef	47.8 a	37.5 cde	30.0 de	38.3	38.9
PV 958	40.0 bcde	50.5 a	40.5 ab	22.5 ij	40.3	36.5
Affirmed	40.3 bcde	46.8 a	34.8 fg	31.5 cd	37.5	39.1
Joliet	42.5 abcd	51.3 a	30.5 ijkl	28.8 efg	36.5	40.0
Jaguar	42.8 abcd	50.0 a	30.8 ijkl	27.0 fg	36.8	38.5
SVGF2074	41.8 abcd	50.5 a	29.8 kl	27.3 fg	35.8	38.9
Bridger	39.0 cdef	50.3 a	35.5 ef	23.8 i	37.3	37.0
Annihilator	37.3 def	49.3 a	33.8 fgh	28.3 efg	35.5	38.8
PV 857	38.3 cdef	49.8 a	32.0 hijk	28.5 efg	35.1	39.1
SVGG1312	42.8 abcd	42.3 a	31.5 hijk	28.8 efg	37.1	35.5
Caprice (std)	42.3 abcd	52.0 a	27.0 mn	23.8 i	34.6	37.9
HM5101 (std)	33.5 f	40.5 a	36.0 def	29.3 def	34.8	34.9
Sybaris	37.5 def	50.8 a	25.0 no	24.5 hi	31.3	37.6
RR 1040	37.3 def	38.5 a	32.8 ghi	28.3 efg	35.0	33.4
SV1286GW	42.0 abcd	42.8 a	28.5 lm	22.5 ij	35.3	32.6
HMC 016203	40.0 bcde	41.3 a	23.8 o	19.8 k	31.9	30.5
Jackson	41.0 abcd	42.3 a	21.0 p	20.3 jk	31.0	31.3
<i>p-value</i>	0.0253	0.0656	<0.0001	<0.0001		
Fisher's LSD¹	6.42	NA	2.39	2.47		
C.V.	11.2	19.8	5.1	6.2		

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

Figure 1. Chart showing total and marketable yield in lbs/acre for all round podded varieties in the June 2 and June 16 planted trials.



Orange and gray bars are the total (gray) and marketable (orange) yields for the June 2 trial.

Blue and gray bars are the total (gray) and marketable (blue) yields for the June 16 trial.

Figure 2. Temperature and Rainfall for the June 2 Planted Round Snap Bean Trial from June 2 (planting) July 30 (final harvest)

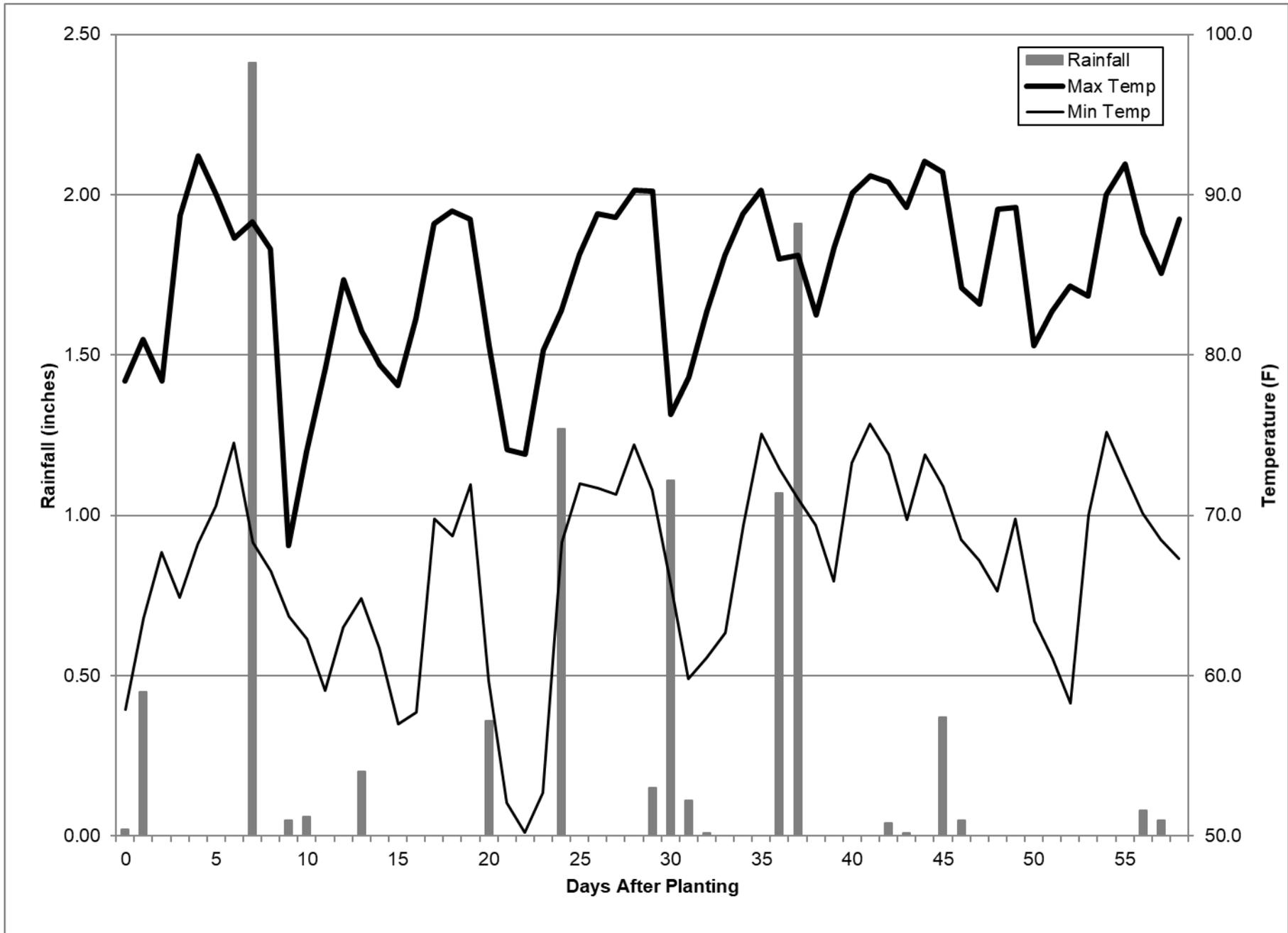


Figure 3. Temperature and Rainfall for the June 16 Planted Round Snap Bean Trial from June 16 (planting) August 20 (final harvest)

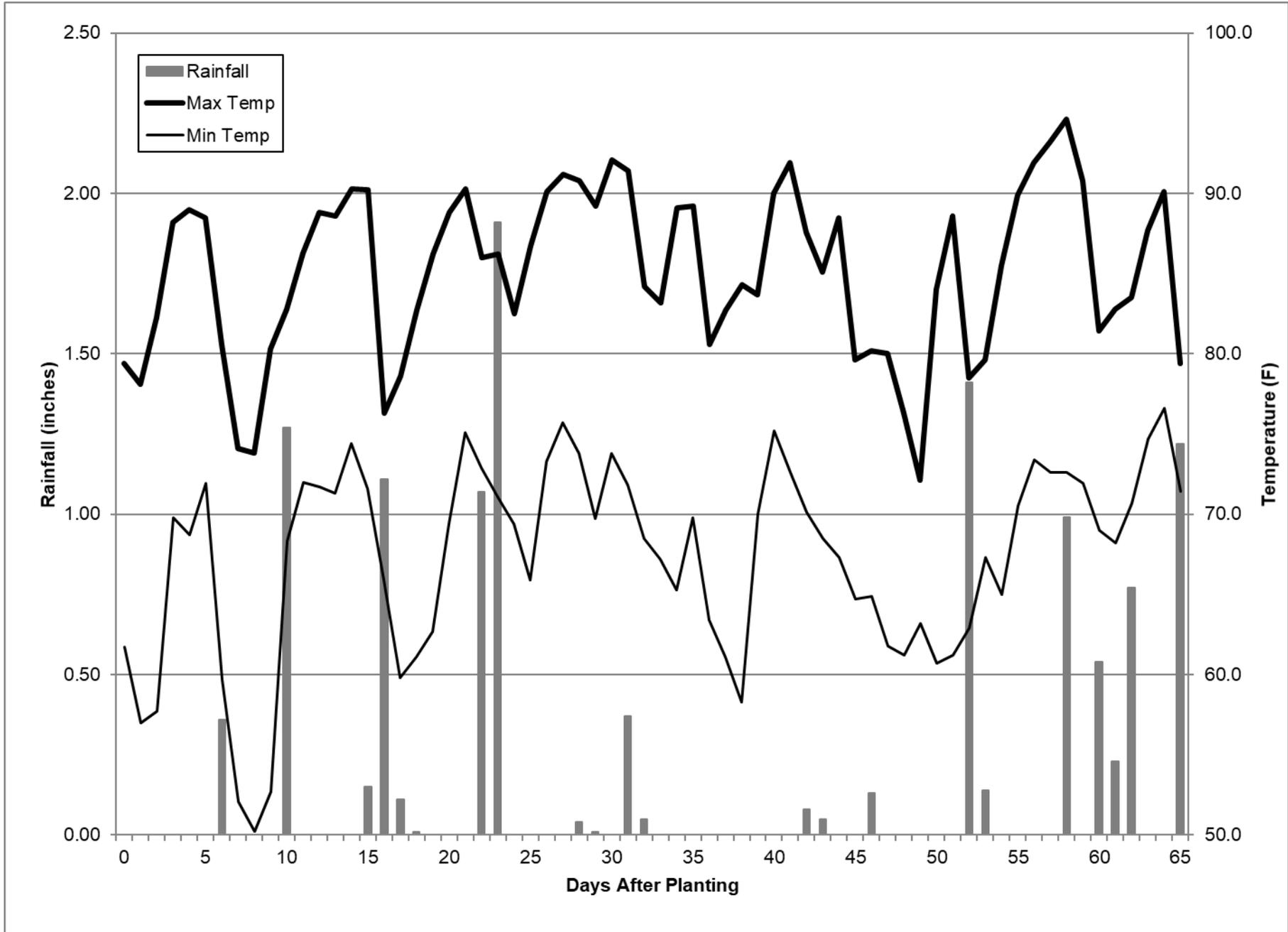


Table 10. Average Seed Length in Millimeters Leading Up to and Including Harvest Date for the May 11-Planted Flat Podded Trial

Variety	Average Seed Length (mm) by Days After Planting/Date					
	52	56	57	59	62	63
	2-Jul	6-Jul	7-Jul	9-Jul	12-Jul	13-Jul
Wav 19	-	8.6	9.0*			
Navajo	6.7	8.7	8.9			
RR 5005	5.3	9.0	7.7			
Memphis	4.9	6.8		9.2		
Solferina	5.7	6.9			11.3	
RR 5001	4.0	6.5			10.9	
Okeechobee	6.2	6.6			9.9	
Usambara	4.5	7.0			8.8	
Asya	-	5.7				11.0
Tapia	5.6	7.3				10.4
BEX175	-	6.4				10.0

*Bold and highlighted lengths are the average of all four replications from the day of harvest.

Table 11. May 11 Planted Trial: Days to Harvest, % Stand; Total, Marketable, Fancy, No.1 and Cull Yield in Pounds Per Acre; Seed Length

	DTH	% Stand	Total Yield (lbs/a)	Mkt Yield (lbs/a)	Fancy Yield (lbs/a)	No. 1 Yield (lbs/a)	Cull Yield (lbs/a)	Average Seed Length ¹
BEX175	63.0 a	81.0 c	11,385 b	8,542 a	4,214 ab	4,328 a	2,842 cde	10.02 c
Solferina	62.0 a	83.7 bc	10,823 bc	7,964 ab	4,628 a	3,336 abc	2,859 cde	11.35 a
Tapia	63.0 a	79.9 c	8,857 bc	6,535 abc	3,303 abc	3,232 abc	2,321 de	10.44 bc
Usambara	62.0 a	90.8 abc	14,653 a	6,091 bc	2,912 bcd	3,179 abc	8,562 a	8.85 e
Wav 19	57.0 c	96.2 a	10,252 bc	6,027 bc	2,117 cde	3,910 ab	4,225 bcd	8.97 e
Okeechobee	62.0 a	95.1 ab	10,781 bc	5,377 cd	2,231 cde	3,146 abc	5,404 b	9.88 cd
RR 5005	56.0 c	88.0 abc	8,112 cd	5,306 cd	2,661 cd	2,645 bcd	2,806 cde	7.66 f
Navajo	57.0 c	98.4 a	9,781 bc	5,230 cd	2,306 cde	2,924 bcd	4,551 bc	8.93 e
Memphis	59.3 b	90.2 abc	9,278 bc	4,360 cde	1,662 de	2,699 bcd	4,918 b	9.16 de
RR 5001	61.8 a	89.7 abc	5,393 de	3,350 de	1,268 e	2,082 cd	2,043 e	10.87 ab
Asya	63.0 a	79.9 c	4,428 e	2,615 e	959 e	1,656 d	1,813 e	10.96 ab
<i>p-value</i>	<i><0.0001</i>	<i>0.0215</i>	<i><0.0001</i>	<i>0.0003</i>	<i><0.0001</i>	<i>0.0208</i>	<i><0.0001</i>	<i><0.0001</i>
<i>LSD</i> ²	<i>1.61</i>	<i>11.89</i>	<i>2978.3</i>	<i>2272.3</i>	<i>1357</i>	<i>1349</i>	<i>2008.1</i>	<i>0.798</i>
<i>CV</i>	<i>1.85</i>	<i>9.31</i>	<i>21.87</i>	<i>28.19</i>	<i>36.58</i>	<i>31.01</i>	<i>36.13</i>	<i>18.61</i>

¹ Target seed size is 9.0 to 11.2 mm. Blue highlight indicates smaller than target size, green indicates target size and yellow indicates larger than target size.

² Means followed by the same letter are not significantly different according to Fisher's LSD.

Table 12. May 11 Planted Trial: Percent of Yield in Each Quality Grade

Variety	% Mkt	% Fancy	% No. 1
BEX175	75.2 a	38.4 a	36.9 a
Tapia	72.7 a	35.8 ab	37.0 a
Solferina	72.4 a	41.9 a	30.5 a
RR 5005	65.6 ab	32.4 abc	33.2 a
RR 5001	63.2 ab	25.0 bcd	38.2 a
Asya	60.2 ab	21.5 cd	38.7 a
Wav 19	58.9 ab	20.8 d	38.1 a
Navajo	53.4 bc	23.5 cd	29.9 a
Okeechobee	50.3 bc	21.1 d	29.1 a
Memphis	50.0 bc	18.8 d	31.2 a
Usambara	41.6 c	19.9 d	21.7 a
<i>p-value</i>	<i>0.0033</i>	<i>0.0005</i>	<i>0.1209</i>
<i>LSD</i>	<i>16.5</i>	<i>11.11</i>	<i>NA</i>
<i>CV</i>	<i>18.93</i>	<i>28.28</i>	<i>24.25</i>

Table 13. May 11 Planted Trial: Pod Lengths and Diameters and Average Seed Length at Harvest

Variety	Pod Length	Pod Width	Seed Length
Wav 19	16.2 a	1.74 abc	8.97 e
BEX175	14.5 b	1.51 gh	10.02 c
Usambara	14.3 b	1.76 ab	8.85 e
Memphis	14.1 bc	1.67 cde	9.16 de
RR 5005	13.7 cd	1.50 gh	7.66 f
Navajo	13.6 cd	1.80 a	8.93 e
Asya	13.2 de	1.47 h	10.96 ab
Okeechobee	12.8 ef	1.65 de	9.88 cd
Tapia	12.7 ef	1.72 bcd	10.44 bc
Solferina	12.4 fe	1.55 fg	11.35 a
RR 5001	11.8 g	1.62 ef	10.87 ab
<i>p-value</i>	<i><0.0001</i>	<i><0.0001</i>	<i><0.0001</i>
<i>LSD</i>	<i>0.64</i>	<i>0.077</i>	<i>0.798</i>
<i>CV</i>	<i>10.69</i>	<i>10.7</i>	<i>18.61</i>

Table 14. May 11 Planted Trial: Plant Height and Width in Centimeters

Variety	Plant Height (cm)	Plant Width (cm)
Navajo	45.3 a	39.8 a
Memphis	44.5 a	42.0 a
Okeechobee	47.8 a	47.8 a
Asya	42.5 a	39.0 a
BEX175	47.8 a	46.5 a
Wav 19	45.0 a	43.5 a
RR 5001	46.8 a	32.8 a
RR 5005	49.3 a	40.5 a
Usambara	52.0 a	45.0 a
Tapia	47.0 a	34.3 a
Solferina	44.3 a	41.3 a
<i>p-value</i>	<i>0.3009</i>	<i>0.2381</i>
<i>LSD</i>	<i>NA</i>	<i>NA</i>
<i>CV</i>	<i>10.2</i>	<i>19.4</i>

Figure 4. Chart showing total and marketable yield in lbs/acre for varieties in the May 11 planted flat podded trial.

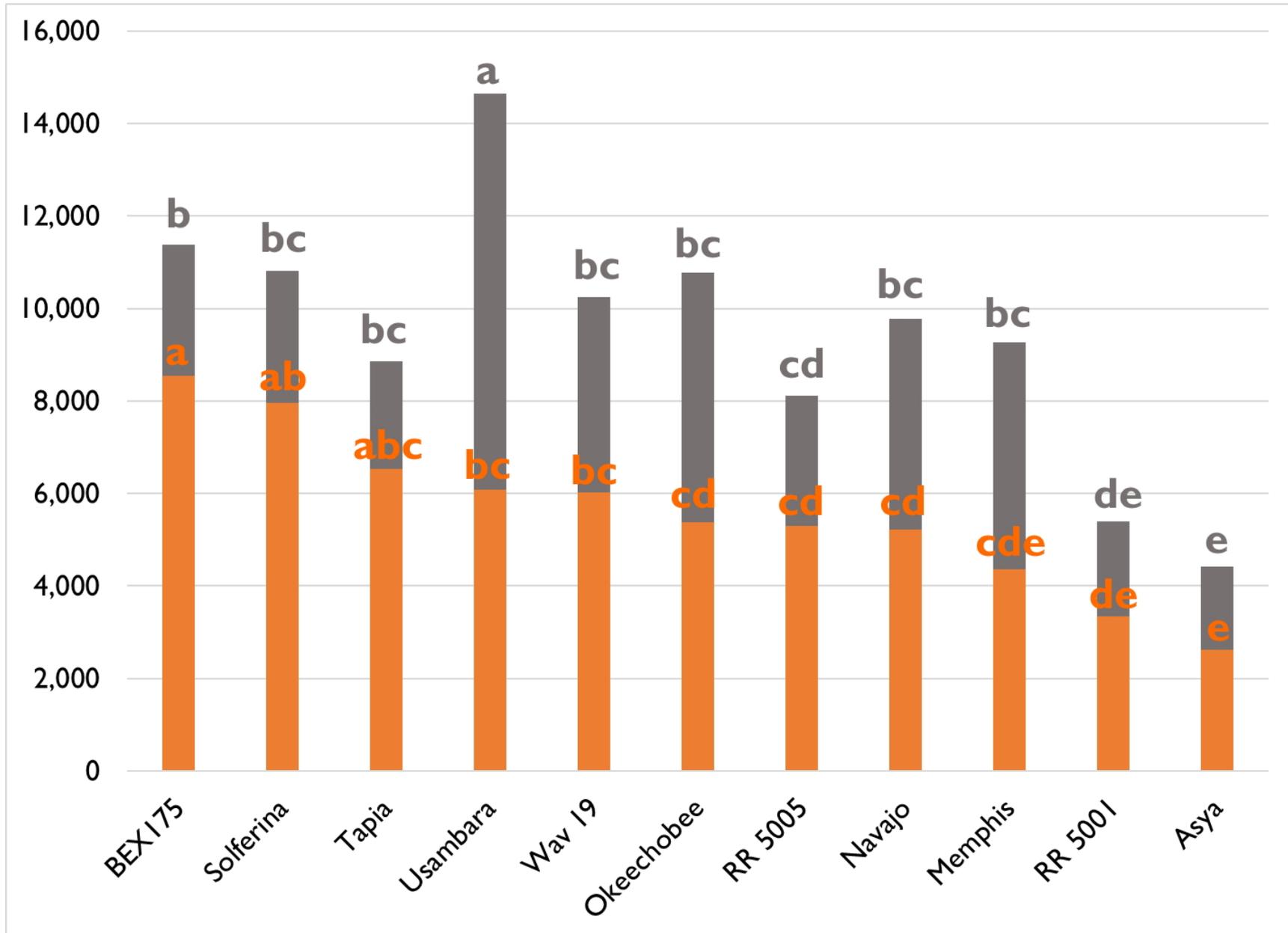
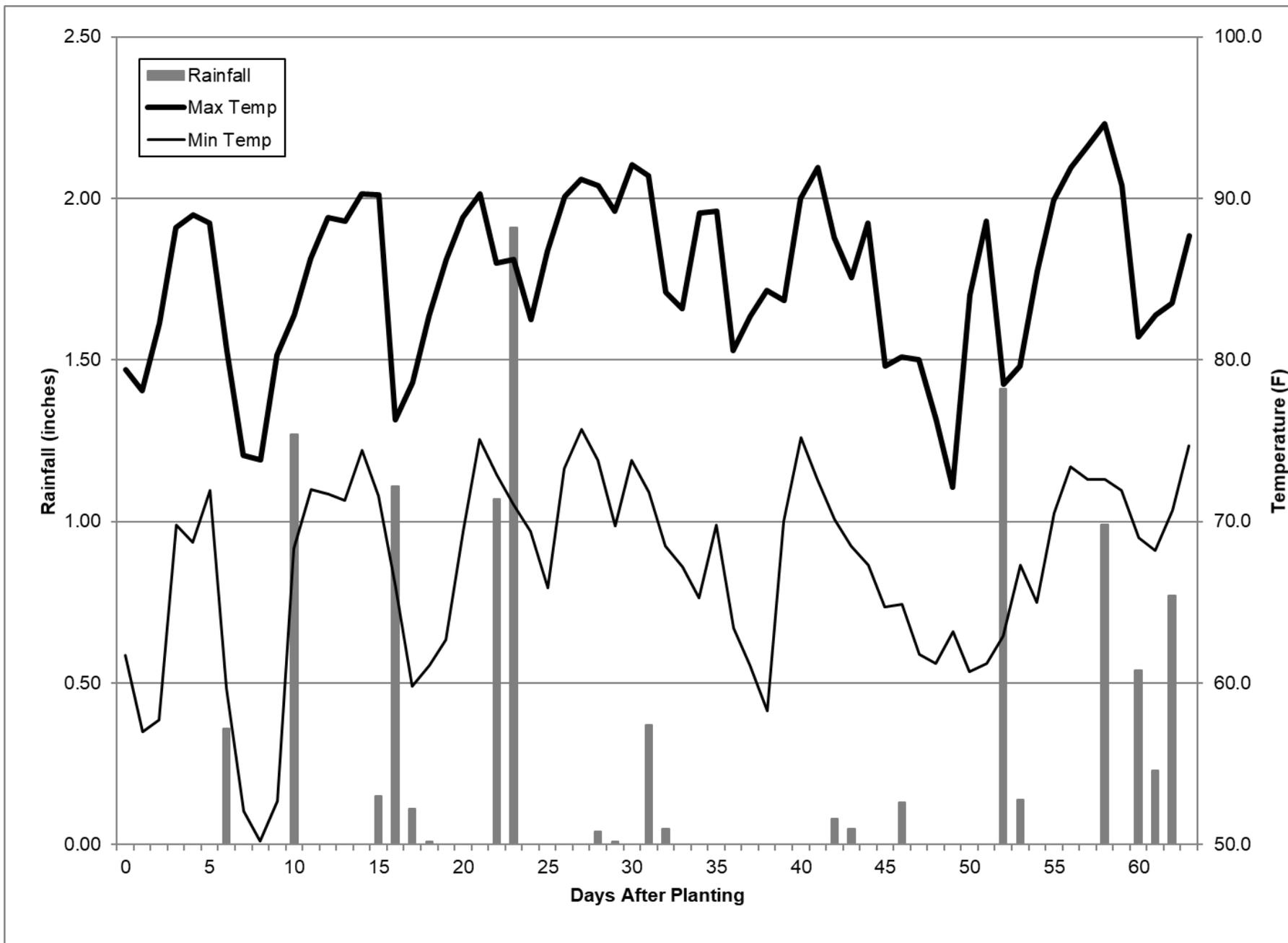


Figure 5. Temperature and Rainfall for the May 11 Planted Flat Snap Bean Trial from May 11 (planting) July 13 (final harvest)



May 11 planted flat-podded trial on July 12, 62 DAP, during harvest.



June 2 planted round podded trial on July 22, 50 DAP, first day of harvesting.



Rep 4 of the June 16 planted round podded trial on August 2, 47 DAP and 10 days before harvest (+ bean harvester parade).



