

Summer Broccoli Variety Trial 2013-2017

Staff Contact:

Liz Kolbe – (515) 232-5661
liz@practicalfarmers.org

Cooperators:

• **Rob Faux** - Tripoli

Funding By:

Ceres Trust

Web Link:

http://bit.ly/pfi_horticulture

In a Nutshell

- After participating in the 2016 Summer Broccoli Variety Trial, Rob Faux wanted to do a 4-year comparison of his yields for Gypsy and Belstar. He collected data in 2017 to match his informal data collection from past years.

Key Findings

- No statistical analysis was performed on the data because the trial did not have replications. However, Gypsy had higher yields for both successions every year.
- 2015 was a good year for summer broccoli, with Gypsy having larger crowns and more crown harvest than other years for Gypsy and all years for Belstar. Gypsy crowns also produced well in 2017.
- Faux's 2016 crop had lower survival rates than previous years and were not healthy long enough for productive side shoots.
- Faux plans to continue using and collecting yield data on both varieties of broccoli.

Project Timeline:

April 2017 - November 2017

Background

Broccoli is classified as a cool-season crop, typically planted in the spring for June harvest and planted again in August for October harvest. Plant breeders, however, are developing varieties of broccoli that are more resistant to heat stress. For broccoli, heat stress is most harmful at the earliest discernible reproductive phase, continues through inflorescence production and



Succession I broccoli trial bordered by onion at Genuine Faux Farm in 2017.

floral initiation, lasting until the broccoli crown is 5-10 mm wide; a time span of 2-3 weeks (Bjorkman and Pearson, 1998). Temperatures above 86 °F can induce heat stress, and can cause broccoli crowns to have non-uniform bud sizes, flattened crowns, yellowing or head leafiness depending on the timing and severity of stress (Dufault, 1996; Bjorkman and Pearson, 1998; Farnham and Bjoerkman, 2011). Temperatures over 86 °F did not affect development of broccoli during vegetative growth or during maturation after the crown was 5-10 mm in diameter (Bjorkman and Pearson, 1998).

Though a cool-season crop, demand for broccoli continues through the summer, so farmers in Iowa want to stretch their

broccoli harvests through the hot months of August and September to capture the market when local supply is low, and to keep broccoli in their CSA boxes as often as possible. That means exposing developing broccoli to some hot June, July and August weather.

In 2016, seven farmers contributed data for the 2016 Summer Broccoli Variety Trial, comparing three summer varieties: Belstar, Gypsy and Imperial. Results from the trial showed that while 2016 was a difficult year for broccoli (due to dampness), Imperial had the highest yield at four farms; on three farms the yield was statistically higher than the other two varieties. Plant spacing differed by farm, but average yield per area was 0.28 lb/ft² for Imperial,

followed by Gypsy (0.27 lb/ ft²), and Belstar (0.22 lb/ft²) (Kolbe, et al., 2016). The full report is available on the Practical Farmers of Iowa website.

While most farmers strongly preferred Imperial following the trial, Rob Faux was interested in completing four years of data he had been informally collecting on Belstar and Gypsy (he prefers Belstar from High Mowing Seed, Gypsy from Johnny's).

Other states have performed variety trials for broccoli tolerance to heat stress. Several of these studies included Gypsy, a variety from Johnny's Seeds. Results from Massachusetts showed that Gypsy performed well in harvest periods from Aug 22 – Sept. 5, with only some unevenness and head leafiness in the second succession (Cavanagh and Hazzard, 2007). Cornell University tested their broccoli hybrids in development by growing them in South Carolina's summer. Their newer varieties performed better than Gypsy, which suffered some yellowing and flattening of crowns, yielding many unmarketable heads in the hot weather trial (Farnham and Bjoerkman, 2011). Penn State Extension trialed 25 varieties, including Gypsy, but tested during spring and fall seasons, not focusing on the summer heat. In that trial, yields for Gypsy were not significantly different than most other varieties tested. On plastic mulch, Gypsy averaged 0.89 lb/crown. On bare soil (at other locations), Gypsy averaged 0.62 lb/crown (PSU Extension, 2014).

Methods

After running the 2016 broccoli variety trial in six replicated plots, Faux wanted to compare his results with previous years and collect varietal data for 2017 to publish four years of summer broccoli yields. In 2014 and 2015, Faux had kept yield records of broccoli heads and side shoots for two (non-replicated) successions of Belstar and Gypsy during the summer months, ending in the fall. This fit well with his two successions of the randomized, replicated trial in 2016, and was simple to continue for 2017. Production practices were consistent by year, and are detailed in **Table 1**. Because the production was not randomized and replicated during 2014, 2015, or 2017, no statistical analysis could be performed. During each year, Succession 1 is earlier in the season, with harvest beginning in late-July to early-August. Succession 2 follows a few weeks later and side shoot harvest extends to early November. The exception to this is 2016, when both successions were harvested from Aug. 16 – Sept. 1; extensive rot in the crop led Faux to pull the plants without harvesting side shoots.

Table 1

Production Practices

| Farm | Faux |
|------------------------|--|
| Harvest Window by Year | 2014: July 31 – Nov. 5; 2015: July 28 – Nov. 15; 2016: Aug 16 – Sept. 1; 2017: Aug. 3 – Oct. 30 |
| In-Row Spacing | 12-16 in. |
| Btwn-Row Spacing | 4-ft bed |
| Configuration | single row |
| Mulch | straw |
| Irrigation | drip |



Gypsy, Succession I, 2017.



Belstar, Succession II, 2017.

Results and Discussion

For each year and each succession, Gypsy showed higher yields and larger crowns than Belstar. Gypsy also had better side shoot production. Data by succession can be seen in **Figure 1**; means by year, across succession, are shown in **Table 2**. Faux likes Belstar because of its shorter stem, tight florets and bluish shade. He noted that Gypsy typically has a softer stem, taller crowns and looser florets. In 2016 he found Imperial to be intermediate of Belstar and Gypsy for his preference of shape and floret tightness.

"One of the features we like about Gypsy is how the stems don't seem to get woody like some broccoli stems do. They may be susceptible to hollow stems at times, but not frequently," said Faux. 2014 and 2017 boasted the highest yield, followed by 2015 and 2016. "After 3-4 years of excellent broccoli production, 2016 was very disappointing," said Faux. The 2016 crop had smaller crowns, very little side shoot production, and high plant mortality. This contributed to overall lower yields for 2016 (**Figure 1** and **Table 2**). "We were relieved to get our broccoli back on track in 2017."

Table 2

Mean Yield by Year for Gypsy and Belstar

| Year | Variety | Crown Weight (lb/crown) | Crown Yield (lb/ft ²) | Yield w/ Side Shoots (lb/ft ²) |
|------|---------|-------------------------|-----------------------------------|--|
| 2014 | Belstar | 0.79 | 0.15 | 0.23 |
| | Gypsy | 0.86 | 0.17 | 0.34 |
| 2015 | Belstar | 0.92 | 0.22 | 0.22 |
| | Gypsy | 1.04 | 0.24 | 0.26 |
| 2016 | Belstar | 0.53 | 0.10 | 0.10 |
| | Gypsy | 0.61 | 0.10 | 0.10 |
| 2017 | Belstar | 0.91 | 0.19 | 0.21 |
| | Gypsy | 1.04 | 0.21 | 0.31 |

Figure 1

Broccoli Yield, 2014-2017, by Variety and Succession

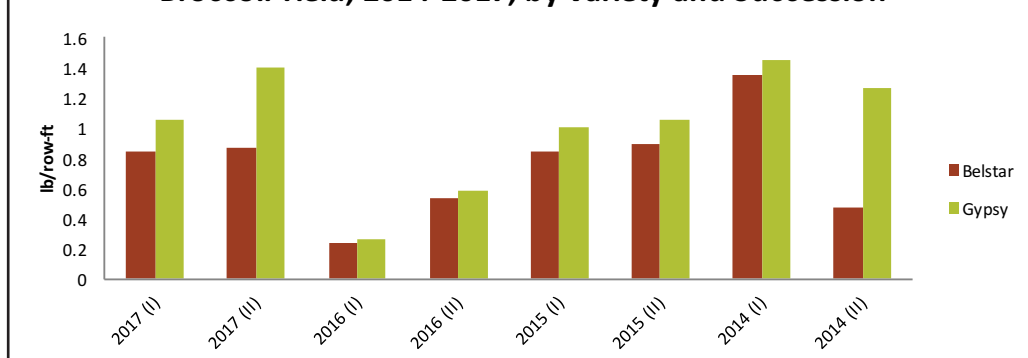


Figure 1. Broccoli yields for both varieties for succession one (I) and succession two (II) from 2014–2017

Conclusions and Next Steps

Faux plans to continue experimenting with summer broccoli, particularly with Belstar from High Mowing Seed and Gypsy. Though he would prefer to use an heirloom or open-pollinated broccoli variety, F1-hybrids provide the necessary production consistency.

"Gypsy is created using cell fusion [plant breeding techniques], which makes us just a little bit ill at ease. On the plus side, the cell fusion process should prevent migration of the traits of this variety. But, I would prefer to see traditional breeding programs to bring types like Early Dividend to fruition for growers. I like what Gypsy has done for us, but will continue to investigate other options. We'll continue to grow Belstar (a traditional F1-Hybrid) and I liked Imperial in last year's trials, but could not find seed in 2017."

References

- Bjorkman, T., and K.J. Pearson. 1998. High temperature arrest of inflorescence development in broccoli (*Brassica oleracea* var. *italica* L.). *J. Exp. Bot.* 49: 101–106.
- Dufault, R.J. 1996. Dynamic Relationships between Field Temperatures and Broccoli Head Quality. *J. Amer. Soc. Hort. Sci.* 121: 705–710.
- Farnham, M.W., and T. Bjorkman. 2011. Evaluation of Experimental Broccoli Hybrids Developed for Summer Production in the Eastern United States. *Hort-science* 46: 858–863.
- Kolbe, L., Beebout, J., Black, C., Faux, R., Hartmann, R., McGary, A., Scheibel, J., and M. Quee. 2016. Summer Broccoli Variety Trial. Practical Farmers of Iowa Cooperators' Program, Ames, IA. http://bit.ly/pfi_horticulture (accessed Nov. 3, 2017).
- PSU Extension. 2014. 2014 Broccoli Variety Trial Results (Vegetable, Small Fruit, and Mushroom Production). Penn State University Extension Available at <http://extension.psu.edu/plants/vegetable-fruit/news/2014/2014-broccoli-variety-trial-results> (accessed May 31, 2016).

PFI Cooperators' Program

PFI's Cooperators' Program gives farmers practical answers to questions they have about on-farm challenges through research, record-keeping, and demonstration projects. The Cooperators' Program began in 1987 with farmers looking to save money through more judicious use of inputs. If you are interested in conducting an on-farm trial contact Stefan Gailans @ 515-232-5661 or stefan@practicalfarmers.org.