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Shawn Wright
University of Kentucky

Darrell Slone
University of Kentucky

John Snyder
University of Kentucky

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Fall Broccoli Cultivar Trial 2012-2013

Shawn Wright, Darrell Slone, and John Snyder — University of Kentucky

Broccoli is a nutritious crop with strong, local demand, but warm summer temperatures often make early summer production in Kentucky difficult. Varieties that will grow well from late summer into autumn could provide a good source of income, increase the availability of nutritious produce, and help meet the demand for more locally produced commodities in restaurants and schools. In eastern Kentucky, growers often plant cabbage and various greens, but broccoli production has been limited in part by lack of information on production practices and variety information. This study was conducted to demonstrate the potential of this production system and to select some varieties for further study.

Materials and Methods

This study was completed at the Robinson Center for Appalachian Resource Sustainability (RCARS) in Breathitt County, Kentucky. Soils are Nolin-Grigsby Series formed in mixed alluvium derived from sandstone, siltstone, and shale with moderate permeability.

Twenty-four varieties selected for a range of characteristics were seeded on July 9 and 10, 2012, into 98-cell plastic plug trays filled with ProMix BX general growing medium (Premier Horticulture, Inc.). Plants were grown for six weeks and then were set into the field on August 20 and 21. For the 2013 planting, twelve varieties from 2012 were selected for a range of maturity and characteristics as well as disease resistance and were seeded on July 8, 2013, using similar trays and growing media. Plants were grown out for seven weeks and transplants were set into the field on August 29. Raised planting beds with drip irrigation were covered with white-on-black plastic, white side up, and with 150 pounds of 19-19-19 per acre spread in the bed at formation. Drip irrigation was not needed either year. Beds were 6 feet on center. The plugs were set using a water-wheel transplanter with approximately 1 cup of starter solution (5 lb of 10-30-20 in 100 gallons of water) applied at transplanting. Plants were 8 inches apart in double rows with 12 inches between rows. Each plot row was 20 feet long and contained 60 plants. In 2012, varieties were replicated nine times and in 2013 four times, in randomized complete block designs. Weeds were controlled between the rows with cultivation and spot spraying of glyphosate where needed. No fungicides were applied either year; in 2012, weather conditions did not allow application and none were needed in 2013. Coragen at 4oz/acre was applied once in 2013 for looper control.

The number of heads and weight per plot were measured each year. Observations were recorded on head size as consumer preference is for smaller head size compared to larger for fresh consumption. We also determined whether a variety was best as a single crown cut variety or was more suitable for bunching several heads together for sale.

Results and Discussion

There was a significant year effect because of distinctly different weather conditions between 2012 and 2013. Autumn 2012 was wetter than normal with greater than 10% more moisture, and it was significantly cooler than normal with an average temperature of 55.8°F, which was 2.4°F cooler than normal. These weather conditions were reflected in much more disease pressure in 2012 leading to only two harvests. Autumn 2013 was significantly drier than normal with less than 60% of average rainfall. It was also 1.3°F cooler than average but still warmer than 2012.

These weather conditions were reflected in much more disease pressure in 2012 leading to only two harvests vs. five harvests in 2013. Downy mildew and bacterial soft rot were the primary diseases that caused such a low harvest in 2012, and there was also significant brown bead, a physiologic issue that causes the florets to turn brown. Broccoli frog eye, also known as cat-eye in some regions, is a physiological condition where excessive or uneven temperatures cause differential development in the inflorescence.

Data were analyzed using SAS and means separated using Duncan's Multiple Range Test. Tables 1 and 2 show mean weights (lbs) and mean head number, for 2012 and 2013, respectively. Means with the same letter are not significantly different. Table 3 lists general varietal characteristics. Hollow stem may be considered undesirable and we collected data on the number of heads having hollow stems at harvest (data not shown). Belstar, Diplomat, Blue Wind, Avenger, Ironman, and Windsor all averaged more than 50% hollow stems. Destiny, Amadeus, Major, Imperial, Emerald Jewel, Bay Meadows, and Gypsy averaged 40-50% hollow stems. Concord, Monaco, Marathon, Maverick, Patron, Everest, and Green Magic had 25-40% hollow stems. Only Alborada, Emerald Crown, Green Gold, and Expo had less than 25% hollow stems. Typically the smaller stemmed varieties do not produce a large crown and are best suited for bunching, whereas the varieties with a large dome head that are cut as a single crown typically have larger stems. Imperial and Ironman were suitable for both as they had nice dome-shaped heads, but small stems that allowed bunching.

This study shows that there is potential for fall broccoli production in eastern Kentucky. Growers could market their produce direct to consumers, through auctions, or through the farm-to-school program. Emerald Crown, Green Gold, and Destiny would be three varieties that should be tried for commercial production based upon this study. For home garden production, consumers should focus upon varieties that have good disease resistance.

Table 1. Mean weights and head numbers per plot 2012.

Variety	Mean Wt. (lbs)	Head Number
Green Gold	8.5 A	10.4 AB
Major	8.5 A	12.1 A
Emerald Crown	8.0 AB	10.9 AB
Gypsy	7.8 ABC	10.4 AB
Green Magic	7.8 ABC	11.4 A
Destiny	7.2 ABCD	9.3 ABCD
Amadeus	6.8 ABCDE	10.3 AB
Windsor	6.8 ABCDE	10.2 AB
Maverick	6.6 ABCDE	9.7 ABC
Diplomat	5.8 ABCDEF	7.1 CDE
Patron	5.2 BCDEFG	9.8 ABC
Imperial	5.0 CDEFG	6.7 DE
Bay Meadows	4.4 DEFGH	8.8 BDC
Everest	4.1 EFGH	9.3 ABDC
Ironman	3.5 FGHI	6.1 FE
Emerald Jewel	3.0 FGHIJ	5.9 FE
Alborada	2.6 GHIJ	4.4 EFGH
Avenger	2.1 HIJ	3.4 FGH
Belstar	1.9 HIJ	5.2 EFG
Monaco	1.8 HIJ	3.1 GH
Marathon	1.5 HIJ	2.7 GHI
Concord	1.0 IJ	2.1 HI
Blue Wind	0.4 J	10.8 AB
Expo	0.2 J	0.3 I

Table 2. Mean weights and head numbers per plot 2013.

Variety	Mean Wt. (lbs)	Head Number
Emerald Crown	28.2 A	47.2 A
Green Gold	24.8 AB	38.7 BC
Everest	24.2 AB	47.2 A
Destiny	23.6 AB	40.2 ABC
Imperial	21.8 BC	43.0 ABC
Ironman	19.6 BCD	28.2 D
Belstar	19.6 BCD	26.0 D
Green Magic	18.1 CD	38.5 BC
Major	17.8 CD	42.5 ABC
Diplomat	17.8 CD	36.7 C
Windsor	15.6 DE	45.5 AB
Expo	12.6 E	13.2 E

Table 3. General varietal observations.

Variety	Seed Source	Bead Size	Head Characteristics	Other
Alborada	BE	Medium	Crown cut	Early
Amadeus	JS	Small	Bunching	
Avenger	SK	Small	Crown cut	Large stem
Bay Meadows	SY	Medium	Crown cut	
Belstar	BE	Small	Crown cut	Large stem
Blue Wind	JS	Large	Crown cut	Early variety
Concord	SY	Large	Crown cut	
Destiny	SK	Small	Bunching	Lots of brown bead
Diplomat	SK	Small	Bunching	Medium stem
Emerald Crown	SK	Fine	Crown cut	Frog eye
Emerald Jewel	SK	Small	Crown cut	
Everest	SY	Medium	Bunching	Small stem
Expo	SK	Fine	Crown cut	Large stem
Green Gold	SK	Fine	Crown cut	Downy mildew
Green Magic	SK	Small	Crown cut	Frog eye
Gypsy	SK	Large	Crown cut	Flat head
Imperial	SK	Fine	Crown cut/Bunching	Good color
Ironman	SM	Fine	Crown cut/bunching	Nice dome
Major	JS	Large	Bunching	Small stem
Marathon	SK	Large	Crown cut	Large stem
Maverick	SK	Medium	Crown cut	
Monaco	SY	Small	Crown cut	Large stem
Patron	SK	Small	Crown cut	
Windsor	ST	Small	Bunching	Small stem