

MARITIME ORGANIC SEED TRIALS: BROCCOLI

Final Research Report E2008-32

BACKGROUND

The organic seed sector is growing, and every year new cultivars are being released for vegetable crops. Certified organic farmers are required to use organically grown seed when it is available for the crop they are growing. However, organic seed has not been available for many of the favourite cultivars grown by Maritime market gardeners and commercial growers. In collaboration with Maritime organic farmers in 2006, the Organic Agriculture Centre of Canada began a research program to explore the current state of organic seed for vegetable crops.

The **objective** of this project was to evaluate existing and novel cultivars of organically grown broccoli seeds to identify the best currently available cultivars for organic production.



Belstar broccoli, a new organically produced hybrid

Table 1. Organically produced and non-organic standard broccoli cultivars tested in this trial

Cultivar	Characteristics
<i>Non-Organic Standards</i>	
<i>Early Dividend</i> ¹	Early F1 (45 d from transplanting)
<i>Arcadia</i> ¹	Late F1 (69 d from transplanting)
<i>Organically Produced Seed</i>	
Belstar ¹	Midseason F1 (66 d from transplanting)
Calabrese sprouting ²	Midseason OP (~60 d from transplanting)
De Cicco ³	Early OP (48 d from transplanting)
Fiesta (2007 only) ⁴	Midseason F1 (65 d from transplanting)
Green Goliath ⁵ (2006 only)	Midseason OP (58 d from transplanting)
Nutribud ¹	Midseason OP (55 d from transplanting)
Waltham 29 ⁶	Late OP (~75 d from transplanting)

WHAT WAS DONE

The organic broccoli seed trial was conducted at three farms (one each in NS, NB and PEI), and repeated for two years. All cultivars were tested for two planting dates: summer (transplanted mid-June) and fall (transplanted mid-July). Each year, six organically produced broccoli cultivars were planted at each site, with two conventional cultivars as a standard for comparison (Table 1). Two of the cultivars were tested in only one year due to limited seed availability (2006: Green Goliath) or the introduction of a new cultivar (2007: Fiesta F1).

The broccoli seedlings were grown in organic potting mix at the NSAC Greenhouse. Trials were planted and harvested by OACC technicians, and maintained (bed preparation, weeding, pest control) by the farmers at each site. Soil fertility was dependent on site conditions; at one site, compost had been applied, while another producer added crabmeal to the plantings.

¹Vesey's Seeds (PE)

²Agrestal Organic Heritage Seeds (ON)

³Johnny's Selected Seeds (ME)

⁴Bejo Seeds, Inc. (US)

⁵Stellar Seeds (BC)

⁶William Dam Seeds (ON)



A dome shaped head (L) compared to a semi-dome head (R), both cut at 8 in. length

Cultivars were planted in a random order in 5-m long rows; twenty seedlings per cultivar were planted. To reflect grower practice, plant density varied between 2.4 plants m^{-2} (1.5' between plants in a row x 3' between rows) to 3.6 plants m^{-2} (1'x3' or 1.5'x2'). Pest pressure was low, but Dipel was sprayed by growers when needed to control imported cabbage worm. Time and travel constraints meant that it was not possible to harvest all 20 heads at their peak of maturity or determine the marketable yield for each cultivar.

Table 2. Yield and head size of broccoli cultivars for two planting dates at Maritime sites, 2006-07

	Yield g m^{-2}	Head Size g head ⁻¹
Fiesta F1	1454 a	413 a
Belstar F1	1318 a	381 a
Arcadia F1	1304 a	376 a
Early Dividend F1	1197 ab	329 ab
Green Goliath	1010 abc	294 ab
Nutribud	891 bc	256 bc
Calabrese Sprouting	584 cd	169 cd
Decicco	522 d	151 d
Waltham 29	371 d	107 d
Summer Harvest	943	259 B
Fall Harvest	980	291 A
<i>P date</i>	0.519	0.035
<i>P cultivar</i>	<0.001	<0.001

A-B; a-d Values within the same column and followed by the same upper or lowercase letter are not statistically different (Tukey test, $P < 0.05$)

Instead, each site was visited 2 – 5 times at harvest and ten mature heads per cultivar were hand-harvested, cutting at 8-in. length. Harvested heads were selected based on maturity. Head weight and the circumference of the crown and stem were measured. A sub-sample of five heads per cultivar was used to assess appearance on a qualitative scale for bud size, evenness, colour, and head shape.

The analysis presented here combines data collected over the two years of this project, combining three sites (blocks) with the two factors of planting date and cultivar.

WHAT WE SAW

Germination results for all cultivars were good in both years; 88-95% in 2006 and 89-97% in 2007.

In the comparison of the midseason and late season broccoli plantings, there were few statistically significant differences observed. Heads were heavier ($P=0.035$) for the late season planting than the midseason planting. We did not see any interactions between planting date and cultivar, which means that most of the cultivars would perform similarly through the season (cultivars that performed best with midseason planting also were best with the late planting). While there are cultivars known to be better cultivars for early vs. late planting, our trial had both close planting dates and high variability between the sites. If we had tested an early spring planting against a late fall planting, the results might have shown differences in cultivar performance.

Summaries of all yield and quality data are presented in Tables 2-5. The two conventional hybrid varieties tested exhibited high yields, with large head size and diameter. Early Dividend had decent yield with large heads of 12.8 cm diameter. The heads had fairly tight, even buds and were a medium green colour and semi-dome shape, flatter than most other tested cultivars. Arcadia was high yielding, with heavy heads of 13.4 cm diameter and thicker stems. The heads were dome-shaped which is preferred for fall production as water will not pool on the head and cause rot. Heads had small, even buds and were judged to have the darkest blue-green colour of all cultivars.

Compared to these conventional standard cultivars, the organic seed cultivars Belstar F1 and Fiesta F1 both appear to be promising alternatives.

Table 3. Broccoli head and stem diameter for broccoli cultivars at Maritime sites, 2006-07

	Head Diameter cm	Stem Diameter cm
<i>Arcadia F1</i>	13.4 a	3.9 bc
<i>Early Dividend F1</i>	12.8 a	3.7 bcd
Belstar F1	12.0 a	4.2 ab
Fiesta F1	11.8 a	4.4 a
Nutribud	11.7 a	3.6 cd
Green Goliath	11.6 ab	3.4 d
Calabrese Sprouting	9.2 bc	2.9 e
Decicco	8.6 cd	2.8 e
Waltham 29	6.9 d	2.7 e
<i>P date</i>	0.447	0.398
<i>P cultivar</i>	<0.001	<0.001

a-e Values within the same column and followed by the same letter are not statistically different (Tukey test, P<0.05)

Both cultivars produced yield and head size statistically similar to Arcadia. Belstar is a hybrid organic broccoli that had high yield with very tight, even buds and a dome-shaped head. It is a blue green colour and the stem is very thick. Fiesta (only assessed in 2007) is not yet commercially available in Canada as organic seed. This cultivar had very high yield, with a thick stem, dome shaped head, and small, even buds and was ranked slightly lighter in colour than Belstar or Arcadia. In the field, it was observed to have short stem length, although harvesting at 8" was not a problem. The large stem diameters contribute to the high head weight and yields observed. A large stem was expected as Belstar was bred as a crown cut variety which is sold after stem removal.



Early Dividend (L) and Nutribud (R) demonstrating differences in bud size and evenness

However, the two conventional varieties were found to have greater head diameter than the organic varieties, an attribute that may be more desirable to producers than higher yield.

The open-pollinated cultivars Nutribud and Green Goliath also performed reasonably well. Green Goliath produced high yield and large head size similar to the hybrid varieties, but appeared less uniform in terms of size and maturity. Heads were medium-green with a semi-dome shape, with some rot in the fall. Nutribud is an open-pollinated cultivar that was bred for nutritional value, and has reported to have high levels of free glutamines. It produced average yield of smaller heads, with slightly larger bud size and skinnier stems. It was an early, reliable producer for both summer and fall.

The other cultivars tested (Calabrese Green Sprouting, Decicco, and Waltham 29) were open pollinated, sprouting broccoli varieties. They were generally lower yielding and produced smaller heads than the others. Bud sizes were larger and evenness was lower and less consistent, but they produced abundant side shoots. They might be good choices for producers who prefer smaller heads for bunching or side shoot harvests, or who are looking for an heirloom variety for their market. Of the three, Calabrese Green Sprouting had the highest yield and largest head diameter and size, although it was ranked poorest for bud evenness.

Table 4. Head shape and colour ratings of broccoli cultivars at Maritime sites, 2006-07

	Head Shape ^Z	Colour ^Y
Belstar F1	4.1 a	3.3 ab
Fiesta F1	3.7 ab	3.1 ab
<i>Arcadia F1</i>	3.7 ab	3.8 a
Nutribud	3.1 bc	2.8 b
Calabrese	2.9 bc	3.0 b
Decicco	2.8 bc	3.0 b
Green Goliath	2.7 bc	2.9 b
Waltham 29	2.5 c	2.9 b
<i>Early Dividend F1</i>	2.5 c	3.2 ab
<i>P date</i>	0.121	0.214
<i>P cultivar</i>	<0.001	0.004

a-c Values within the same column and followed by the same letter are not statistically different (Tukey Test, P<0.05)

^Z1 - flat head, 5 - domed head

^Y1 - light green, 5 - dark blue-green

Table 5. Bud size and evenness ratings of broccoli cultivars at Maritime sites, 2006-07

	Bud Size ^Z	Bud Evenness ^Y
Belstar F1	1.9 a	2.1 a
Fiesta F1	2.3 ab	2.5 ab
<i>Arcadia F1</i>	2.3 ab	2.2 a
Green Goliath	2.4 ab	2.9 abc
<i>Early Dividend F1</i>	2.6 b	2.6 ab
Calabrese	3.4 c	3.5 c
Decicco	3.4 c	3.1 bc
Nutribud	3.4 c	3.1 bc
Waltham 29	3.4 c	2.8 abc
<i>P date</i>	0.596	0.596
<i>P cultivar</i>	<0.001	<0.001

a-c Values within the same column and followed by the same letter are not statistically different (Tukey Test, P<0.05)

^Z1 - smaller buds, 5 - larger buds

^Y1 - more even, 5 - less even

THE BOTTOM LINE...

Fiesta and Belstar, two hybrid broccoli cultivars available as organic seed, were similar in yield and quality attributes to the conventional standard varieties tested, although they had a slightly smaller head diameter and thicker stem. Two open pollinated varieties, Green Goliath and Nutribud, were also found to yield well.

Maritime farmers are encouraged to try these organic cultivars on their own farms.

CREDITS

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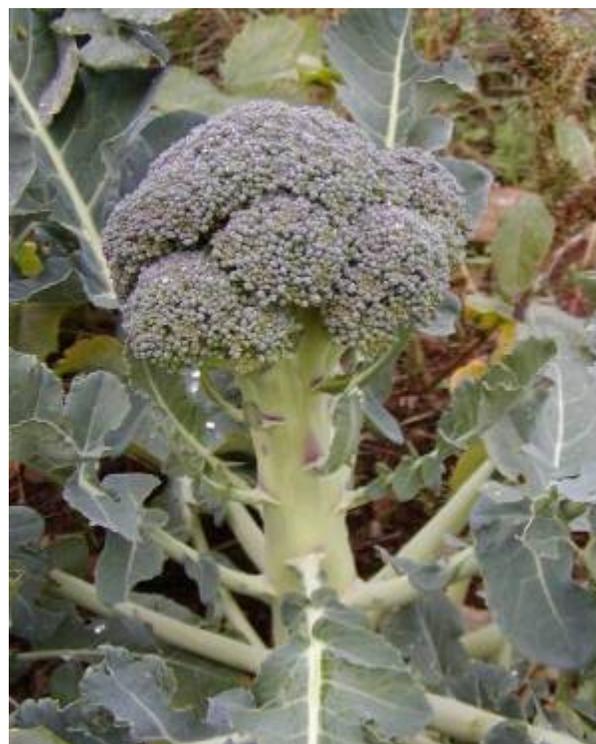
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Fiesta broccoli, a hybrid organic cultivar, is shown in cross-section

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