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## Onion Variety Trial 2014

Rebecca Brown

*brownreb@uri.edu, brownreb@uri.edu*

Noah Leclaire-Conway

*University of Rhode Island, noah.conway@gmail.com*

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# URI Onion Variety Trial Report

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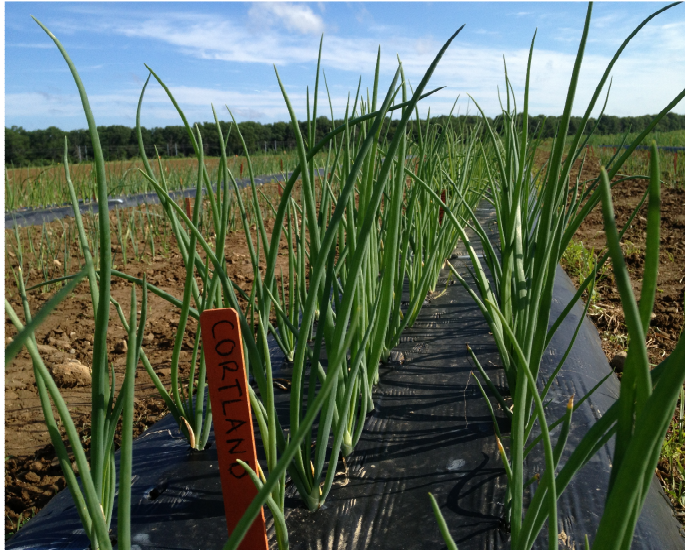
Rebecca Brown and Noah LeClaire-Conway

## Trial Conditions

Funding from a Specialty Crops Farm Viability Grant through the Rhode Island Department of Environmental Management's Division of Agriculture permitted us to conduct onion variety trials in 2012 and 2013. In 2012 we trialed 18 yellow storage onion varieties, three red onion varieties, and one sweet onion. The 2013 trial included 17 yellow storage onion varieties, 3 sweet yellow onion varieties, one sweet white variety, and 7 red onion varieties. The onion varieties were evaluated for yield, quality, storability, and suitability to plasticulture. All of the onions were started from seed in the greenhouse and transplanted into raised beds covered with plastic mulch. In 2012 transplanting took place on April 13 and beds were covered with conventional plastic mulch. In 2013 transplanting took place on April 30 and beds were covered with biodegradable BioTelo plastic mulch. In major production areas onions are direct-seeded into bare ground, however, this production system requires extensive use of herbicides and frequent hand weeding. The use of transplants and plastic mulch essentially eliminates weeding within the beds. Varieties differ in how reliably the bulbs form above the mulch, and bulbs that form partly or entirely below the mulch are at increased risk of thrips damage, bulb rot, and mis-shaped bulbs. Each 4-ft bed contained 3 rows of onions, with an in-row spacing of 4 inches. All fertilizers were incorporated during bed construction; water was provided by rainfall supplemented with overhead irrigation.



The 2013 onion trial at transplanting. Leeks were planted in open furrows between the raised beds of onions.



The variety Cortland in June 2013. Cortland was very vigorous and had excellent transplant establishment, leading to high yields.

Transplant survival was evaluated in June of each year. Thrips damage, foliage color, leaf angle, and suitability to plasticulture were evaluated in late July and early August, when bulbs had reached full size. Purple blotch disease (caused by *Alternaria porri*) occurred in 2012 but there were no significant differences in disease severity between varieties. Each variety was harvested when 50% of the tops were down. In 2012 the harvest period was August 3-27. In 2013 harvest began on August 7 and continued until September 3. Harvested onions were culled for size and rot prior to curing. In 2012 onions were spread on benches in a warm greenhouse to cure. The greenhouse was not available in 2013 so onions were tied into bunches and hung in the barn to cure. Once the necks were fully dry the tops were removed, and the onions were culled a second time to remove bulbs that rotted during curing.

A subsample of each storage variety was packed in mesh onion bags (1 10-lb bag per variety) and placed in refrigerated storage. Onions in storage were re-graded periodically to remove bulbs that had rotted or sprouted.

## Sweet Onions

The yellow sweet onion varieties were 'Ailsa Craig', 'Candy', and 'Walla Walla'. The one white onion variety in the trial was 'Sierra Blanca'. All of the sweet onions had problems with bulb rot and plant death prior to bulb formation. 'Sierra Blanca' in particular had only 75% transplant establishment. Thrips damage was considerable on all four varieties, with ratings from 1.8 to 2.2, and there were no significant differences. 'Walla Walla' had the bluest foliage, significantly darker than the other varieties. 'Candy' had the greenest foliage, with the other varieties in between. 'Ailsa Craig' was well-adapted to plasticulture, while 'Walla Walla' and 'Sierra Blanca' did not do well on plastic. 'Candy' was intermediate, significantly less adapted than 'Ailsa Craig' but better than 'Walla Walla' and 'Sierra Blanca'. 'Ailsa Craig', 'Walla Walla' and 'Sierra Blanca' had medium to large bulbs with fair uniformity of



Ailsa Craig at bulb maturity. Bulbs formed mostly above the plastic, which makes the variety well-suited to plasticulture. Quality was high at this stage, but rot was a problem as tops were drying down.

size. 'Candy' was not at all uniform. All four varieties were harvested on August 12. 'Candy' yielded the most marketable bulbs, averaging 28 out of 45 transplants or 66% marketable. 'Ailsa Craig' had the fewest marketable bulbs, averaging 16.3 out of 45 or 37%. This was significantly less than 'Candy'. 'Walla Walla' and 'Sierra Blanca' were similar to each other and intermediate, although 63% of the 'Sierra Blanca' plants that survived transplanting produced marketable bulbs. Most of the losses were due to rot. Bulb size ranged from 4.7 ounces for 'Sierra Blanca' to 6.0 ounces for 'Candy' but differences were not significant. 'Sierra Blanca' and 'Candy' cured nicely, with minimal losses during curing. In contrast, 'Walla Walla' and 'Ailsa Craig' lost 29% of the bulbs during curing. Only one third of the original transplants yielded marketable cured bulbs for these varieties. The sweet onions were not evaluated for storage.

Sweet onions are difficult to grow in New England, and the extremely wet weather in June 2013 did not help. 'Ailsa Craig' and 'Walla Walla' appear to be best suited to production for early sales as green bulb onions prior to maturity. 'Candy' and 'Sierra Blanca' would work for mature sweet onion production.

### Sweet Onion Data

Variety	Foliar Color <sup>a</sup>	Plastic <sup>b</sup>	Bulb Size (oz.)	Fresh Yield	Cured Yield
Ailsa Craig	2.3	1.2	5.36	37%	27%
Candy	1.5	2.4	5.40	67%	67%
Walla Walla	3.2	2.5	5.87	45%	30%
Sierra Blanca	2.2	3.3	4.73	63%	62%
LSD <sup>c</sup>	0.8	0.9	NS	21%	16%

<sup>a</sup> For foliar color 1 = yellow-green and 4 = blue

<sup>b</sup> Plastic is the suitability of the variety for use in plasticulture, with a score of 1 indicating that the variety is well suited.

<sup>c</sup> Within a column values that differ by the LSD value or more are significantly different

## Yellow Storage Onions

Pungent yellow onions are the most common type in the market. There are dozens of long day varieties available, and some of them do quite well in southern New England. We trialed 18 varieties in 2012 and 17 in 2013, with 14 varieties trialed in both years. All varieties established well in 2013, with greater than 90% survival. In 2012 establishment survival ranged from 79% to 100% with a least significant difference of 15%.



Yellow storage onions curing in the greenhouse in 2012. The slatted benches worked very well for curing onions, but the greenhouse was destroyed in a blizzard over the winter of 2012-13.

‘Bridger’ had the best yield in 2013, with 91% of the transplanted seedlings producing marketable onions. It also had very low losses during curing. Storage quality is intermediate, with 37% loss after 5 months. ‘Bridger’ is early and relatively large; bulbs average 8.4 oz. ‘Bridger’ was not included in the 2012 trial, where ‘Prince’ had the best yield. Marketable fresh yield was 91%, and only 6% of the bulbs were lost during curing. Bulb size was similar to Bridger at 8.2 oz. Unfortunately ‘Prince’ failed to germinate in 2013, so the two varieties were not directly compared.

Field location had a noticeable effect on the amount of bulb rot both years, resulting in least significant difference values of 26 to 32 for yield measurements. In 2012, 12 other varieties were statistically similar to ‘Prince’, with marketable fresh yields of 61 to 89%. Nine varieties were statistically similar for marketable cured yield, ranging from 56 to 83%. In 2013 10 other varieties were similar to ‘Bridger’ for fresh yield, ranging from 68 to 84%. Only 4 varieties were similar for cured yield, with values from 68 to 81%. ‘Copra’ and ‘Cortland’ were the only varieties that were in the top group for cured yield in both

years. ‘Gunnison’ and ‘Highlander’ were in the top group in 2012 and not trialed in 2013. In addition to ‘Copra’ and ‘Cortland’ varieties in the top group for fresh yield for both years were ‘Calibra’, ‘Safrane’, ‘Braddock’, ‘Sarape Café’, ‘Sedona’, ‘Verrazano’, and ‘Patterson’. ‘Verrazano’ and ‘Patterson’ cured well

## 2012 Yield Data

Variety	Establishment	Fresh Yield	Cured Yield	Storage Loss	Bulb Size (oz.)
<i>LSD</i>	15%	32%	31%	<i>a</i>	2.6
Braddock	82%	76%	68%	42%	5.4
Brandt	82%	48%	32%	50%	5.7
Calibra	87%	88%	81%	22%	8.6
Copra	100%	84%	79%	16%	5.5
Cortland	88%	89%	79%	30%	6.4
Dakota Tears	91%	47%	32%	50%	6.0
Gunnison	100%	85%	83%	23%	7.9
Hendrix	88%	69%	50%	38%	7.1
Highlander	92%	80%	80%	20%	5.8
Madras	98%	58%	38%	70%	6.7
Patterson	79%	61%	50%	62%	4.6
Pontiac	91%	58%	56%	<i>b</i>	7.2
Prince	100%	91%	86%	20%	7.6
Safrane	98%	87%	65%	35%	7.6
Sarape Café	100%	76%	46%	58%	8.2
Sedona	95%	73%	63%	24%	9.8
Verrazano	81%	63%	50%	46%	7.3
Yankee	88%	43%	37%	62%	5.2

Colored bars indicate varieties that were trialed in 2012 only. Entries must differ by at least the LSD value for the column in order to be statistically different. Yield values are a percentage of established transplants. (a) The storage trial was not replicated, so significant differences could not be determined. (b) The bag of ‘Pontiac’ onions was misplaced during transfer to storage so no data are available.

in 2013 but not in 2012, and ‘Calibra’ cured well in 2012 but not 2013. The other varieties had high curing losses both years. Storage losses for these high yielding varieties ranged from 16 to 62% in 2012 and 12 to 65% in 2013. Varieties with the lowest storage losses were ‘Copra’, ‘Highlander’, ‘Prince’, ‘Calibra’, ‘Gunnison’, and ‘Sedona’ in 2012 and ‘Sarape Café’, ‘Calibra’, ‘Verrazano’, ‘Talon’, and ‘Braddock’ in 2013. Interestingly ‘Copra’, which normally has exceptional storage quality, lost 47% of the bulbs in storage in 2013, with most of those rotting in the first two months. In general the majority of losses occurred in the first months in storage, and most bulbs that were sound on December 9 were still sound on March 28.

## 2013 Yield Data

Variety	Fresh Yield	Cured Yield	Storage Loss	Bulb Size (oz.)
<i>LSD</i>	26%	26%		1.5
<b>Braddock</b>	73%	59%	24%	4.6
<b>Bridger</b>	91%	89%	40%	3.4
<b>Calibra</b>	82%	62%	13%	5.4
<b>Copra</b>	73%	68%	47%	4.5
<b>Cortland</b>	84%	81%	62%	5.5
<b>Dakota Tears</b>	62%	23%	29%	4.4
<b>Hendrix</b>	56%	36%	25%	6.2
<b>Madras</b>	54%	28%	33%	4.1
<b>NY Early</b>	54%	54%	55%	4.1
<b>Patterson</b>	83%	79%	68%	5.5
<b>Pontiac</b>	58%	38%	53%	6.2
<b>Safrane</b>	82%	36%	28%	5.2
<b>Sarape Café</b>	70%	56%	12%	5.2
<b>Sedona</b>	69%	54%	45%	5.7
<b>Talon</b>	68%	54%	23%	5.5
<b>Verrazano</b>	71%	71%	21%	5.4
<b>Yankee</b>	53%	40%	18%	3.8

Colored bars indicate varieties that were trialed in 2013 only. Entries must differ by at least the LSD value for the column in order to be statistically different. Yield values are a percentage of established transplants. The storage trial was not replicated, so significant differences could not be determined.

In addition to yield, varieties were evaluated for susceptibility to thrips, foliar color, axil angle, and suitability to plasticulture. Foliage color and neck axil are connected to thrips susceptibility as thrips have been shown to prefer bluish, waxy leaves and tight neck axils. However, glossy leaves and open axils may contribute to greater foliar disease and bulb rot, particularly in wet climates. Thrips damage ratings ranged from 1.7 to 3.0 in 2012, and 2.3 to 3.5 in 2013. Lower numbers indicate less damage, so damage was generally worse in 2013. In 2012 six varieties were in the top group with scores below 2.2, but in 2013 there were no significant differences in thrips damage between varieties. Color ratings were similar in both years, with 'Calibra' and 'Sarape Café' having the greenest leaves and 'Braddock', 'Madras', 'Yankee', 'Safrane', 'Copra', 'Cortland', 'Patterson', and 'Dakota Tears' having very blue leaves. The average thrips damage ratings were 2.7 and 2.6 in 2012 and 2013, respectively, for the varieties with the greenest leaves. For the blue-leaved varieties the averages were 2.3 and 3.1 in 2012 and 2013, respectively, suggesting that foliage color does not have any meaningful relationship to thrips damage under our conditions. Leaf axil was only rated in 2012. 'Safrane' had the tightest neck axils, while 'Yankee' had the most open. A total of 10 varieties grouped with 'Safrane', and 11 with 'Yankee'. The average thrips damage rating for the Safrane group was 2.2, versus 2.5 for the Yankee group. These values suggest that neck axil is not related to thrips damage under our conditions either. Fresh yields averaged 74% for the Safrane group and 69% for the Yankee group, suggesting that tight neck axils may reduce bulb rot, but the differences are slight.

## Tolerances to Thrips and Plasticulture

Variety	Leaf axil tightness <sup>a</sup>	Foliar Color <sup>b</sup>	Thrips Damage <sup>c</sup>		Plasticulture Rank <sup>d</sup>	
			2012	2013	2012	2013
Braddock	3.0	3.2	2.7	3.3	9	7
Brandt	3.3	3.7	2.3	--	8	--
Bridger	--	2.8	--	3.3	--	6
Calibra	2.3	1.3	2.7	2.7	4	1
Copra	2.7	3.4	2.3	2.8	5	3
Cortland	2.7	3.6	2.0	3.2	7	4
Dakota Tears	2.3	3.8	3.0	3.5	6	4
Gunnison	3.3	3.0	1.7	--	3	--
Hendrix	2.3	3.2	2.3	2.7	4	2
Highlander	3.0	3.0	2.7	--	7	--
Madras	2.7	3.6	2.3	3.2	1	2
NY Early	--	2.8	--	3.0	--	6
Patterson	3.7	3.8	2.0	3.2	6	5
Pontiac	2.3	2.5	2.7	2.3	3	2
Prince	3.3	3.0	2.3	--	5	--
Safrane	4.0	3.4	1.7	2.7	2	2
Sarape Café	3.7	1.5	2.7	3.0	3	1
Sedona	3.3	2.7	1.7	3.0	2	2
Talon	--	2.7	--	2.7	--	3
Verrazano	3.0	2.7	2.7	2.5	3	5
Yankee	2.0	3.7	2.0	2.8	9	4
<i>LSD</i>	<i>1.2</i>	<i>0.9</i>	<i>0.5</i>	<i>NS</i>		

<sup>a</sup> Leaf axil tightness was rated on a scale of 1-4 where 1 indicates a loose axil (spreading leaves) and 4 indicates a tight axil (upright leaves). Data collected in 2012 only.

<sup>b</sup> Color was rated on a 1-4 scale where 1 indicates green leaves and 4 indicates blue (waxy) leaves. Data is the average of both years.

<sup>c</sup> Thrips damage was rated on a scale of 1-4 where 4 indicates severe damage. There were no significant differences between varieties in 2013.

<sup>d</sup> Suitability to plasticulture was rated on a 1-4 scale where a score of 1 indicates that a variety does well on plastic. There were no significant differences among varieties in 2013, so data are reported as ranks.

Onions have shallow root systems and very limited canopy, and plastic mulch can be an effective solution to reducing competition from weeds and providing consistent soil moisture. However, if the bulbs develop below the plastic they suffer from increased thrips damage and rot, and it is also possible for the plastic to girdle the bulbs, resulting in deformed bulbs. When we compared suitability ratings across years for those varieties that were grown both years, there was a correlation of 74% which suggests that there are consistent differences in suitability among varieties. We had good separation of ratings in 2012 but no significant differences between varieties in 2013. 'Braddock' was the least suited in both years. In 2012 'Yankee' tied with 'Braddock', but it ranked 4<sup>th</sup> in 2013. 'Madras' ranked first in 2012, followed by a tie for second between 'Safrane' and 'Sedona'. Those varieties all tied for second in 2013, along with 'Hendrix' and 'Pontiac'. 'Calibra' and 'Sarape Café' tied for first. 'Sarape Café' ranked 3<sup>rd</sup> in 2012, and 'Calibra' was 4<sup>th</sup>, but there was a 4-way tie for 3<sup>rd</sup>.



In conclusion, ‘Prince’ and ‘Bridger’ are the best varieties for total yield, and are well-suited to fall sales. Both are intermediate on plastic, and have significant losses in storage. ‘Copra’ and ‘Cortland’ are other good choices for fall sales, while ‘Calibra’ did well in storage both years. There was a lot of variation between years, but ‘Yankee’, ‘Madras’, ‘Dakota Tears’ and ‘Hendrix’ did poorly in both years and are not recommended.

## Red Onions

We trialed three varieties of red onions in 2012, and seven varieties in 2013. ‘Red Bull’, ‘Red Defender’, and ‘Red Wing’ were trialed in both years. Establishment was better in 2013 than in 2012, but there were no significant differences between varieties in either year. In 2012 68 to 78% of the bulbs were marketable at harvest, as compared to 62 to 67% in 2013. There were no significant differences between varieties in either year. Results for cured bulbs were similar, with no significant differences and yields ranging from 52 to 74% in 2012 and 51 to 56% in 2013. ‘Red Defender’ had the largest bulbs, averaging 8.2 ounces in 2012 and 5.4 ounces in 2013. Both ‘Red Defender’ and ‘Red Wing’ had good size uniformity within plots, but ‘Red Bull’ was highly variable. ‘Red Defender’ was highly variable between plots in 2012. ‘Red Bull’ had the highest storage losses in both years. ‘Red Defender’ had greener foliage than the other varieties both years; the difference was significant in 2012 but not in 2013. There were no significant differences in thrips damage or leaf axil. In 2012 ‘Red Defender’ was significantly better suited to plastic than the other varieties, but in 2013 it did not do as well while the other varieties did better, with the result that all three varieties were similar.

### Multi-year comparisons for ‘Red Bull’, ‘Red Defender’, and ‘Red Wing’

Variety	Fresh Yield		Cured Yield		Storage Loss		Bulb Size (oz.)	
	2012	2013	2012	2013	2012	2013	2012	2013
Red Bull	68%	65%	52%	56%	41%	49%	5.8	4.94
Red Defender	78%	67%	74%	52%	22%	47%	8.2	5.40
Red Wing	72%	62%	64%	51%	30%	27%	5.0	4.63

In 2013 four additional varieties were added to the trial: ‘Red Hawk’, ‘Red Jewel’, ‘Red Sky’, and ‘Ruby Ring’. Establishment was excellent for all varieties. None of the new varieties out-yielded the repeated varieties. ‘Ruby Ring’ yielded poorly, with only 40% marketable yield at harvest and 37% after curing. It also had significantly smaller bulbs than the other varieties, averaging only 3.9 ounces. ‘Red Jewel’ and ‘Red Sky’ had intermediate fresh yields while ‘Red Hawk’ was within the range of the repeated varieties. However, ‘Red Hawk’ had over 50% loss during curing, resulting in even lower yields than ‘Ruby Ring’. ‘Red Jewel’ and ‘Red Sky’ cured well, with cured yields similar to ‘Red Bull’. None of the red onion varieties stored well; losses ranged from 19% for ‘Red Hawk’ to 77% for ‘Ruby Ring’. ‘Red Wing’ was second-lowest at 27% and is probably the best choice for storage because of the high losses during curing for ‘Red Hawk’. ‘Red Sky’, ‘Red Jewel’ and ‘Red Hawk’ were very susceptible to thrips, incurring significantly more damage than ‘Red Bull’. Color and suitability to plasticulture were similar across all varieties.

## 2013 Data

Variety	Fresh Yield	Cured Yield	Storage Losses	bulb size (oz)	Thrips Damage <sup>a</sup>
Red Bull	65%	56%	50%	4.94	2.3
Red Defender	67%	52%	50%	5.40	2.7
Red Hawk	64%	28%	19%	5.10	3.5
Red Jewel	51%	47%	67%	5.45	3.8
Red Sky	53%	51%	35%	4.20	4.0
Ruby Ring	40%	37%	77%	3.88	2.0
Red Wing	62%	51%	27%	4.63	2.7
<i>LSD</i>	23%	23%		1.50	1.0

<sup>a</sup> Thrips damage was rated on a 1-4 scale where 1 indicated minimal damage.

In conclusion, none of the red onion varieties trialed were impressive. Rot was a major problem, and yields were much lower than for the yellow storage onions. Yields were also lower than the best of the sweet onions. We noticed that the red onions tended to mature late, and that the tops do not fall. Instead damage from thrips and fungi accumulate until the leaves senesce from the tips down. It may be that red onions would do better if cultural practices were implemented to induce senescence once bulbs reached full size.

### Seed Sources for Trialed Varieties

Seed Company	Varieties			
Bejo <sup>a</sup>	Madras	Red Jewel	Red Hawk	Red Bull
	Safrane	Red Sky	Braddock	
	Yankee	Ruby Ring	Patterson	
dp Seeds	Sarape Café			
Harris Seeds	Candy	Red Defender		
High Mowing Seeds	Calibra*	Talon*	Red Bull*	Sedona*
	Dakota Tears*	Red Wing*	Cortland*	
Johnny's Selected Seeds	Red Wing*	Candy	Patterson	Gunnison
	Red Bull	Sierra Blanca	Alissa Craig	Pontiac
	Copra	Walla Walla*	New York Early*	Bridger
	Cortland*			
Sieger's Seeds	Braddock	Prince	Highlander	Hendrix
	Brandt	Verrazano	Pontiac	

<sup>a</sup> Bejo does not sell seeds directly to growers, but Bejo varieties are carried by many regional seed retailers.

\* Variety is available as Organic seed