

## Season Extension: Small Potatoes Farm

Small Potatoes Farm, Minburn, IA

The demand for local food in central Iowa outstrips supply in many types of markets, even during peak harvest season. Unmet demand is particularly evident outside the regular growing season. The same time period that direct-market produce farms experience declines in sales and cash flow. Season extension of vegetable crops to meet unmet demand and moderate farm cash flow often requires capitalization, purchased energy and new skill sets such as construction and maintenance of hoop houses.

Small Potatoes Farm tends toward using ecological services or existing infrastructure to meet production, economic or other goals prior to purchase of new inputs, assets or infrastructure development. With that in mind, Small Potatoes undertook a season extension demonstration project during the 2009 season designed to help answer the following questions:

1. Can direct-market vegetable farmers increasingly meet demand and increase cash flow during the off-season by growing, storing and marketing more crops amenable to regular-season production and storage within existing facilities?
2. Can off-season marketing of storage crops be done without substantially extra labor, energy and infrastructure costs?
3. Are there sufficient varieties of crops with the traits necessary for simple, effective storage for future marketing?
4. Will the market embrace those crops that have the necessary storage characteristics?

To help answer those questions, the following steps were taken:

1. Test traditional storage crops rutabagas, beets and carrots for storage potential during the off-season.
2. Store crops in existing, under-utilized facilities.
3. Monitor quality and life of chosen storage crops.
4. Record popularity and ease of marketing of storage crops during off-season time periods at various market outlets.

### In-field agronomic properties of storage crops during demonstration

We grew a mid-season planting of rutabagas, beets, and carrots during 2009. Beet varieties trialed were 'Red Ace' (red) and 'Touchstone Gold' (orange/golden), carrot varieties were 'Bolero' (orange) and 'Jaune de Doubs' (yellow), and rutabaga varieties were 'Laurentian' and 'Helenor'. These root crops were selected due to reported or observed storage potential. These crops were harvested near the end of the growing season for off-season storage and marketing. We recorded planting date, seed spacing, plant spacing and row spacing, days to emergence, plant vigor and canopy dates.

Crops were scheduled to be planted so they would be ready for harvest during the month of September. Beets were planted July 6<sup>th</sup>, carrots July 2<sup>nd</sup> and rutabaga June 15<sup>th</sup>. These planting dates deviated from target planting dates by about one to two weeks because of weather and field conditions (Table 1).

Table 1. Storage crop varieties with target and actual planting dates.

Crop	Variety	Self-reported Days to Maturity	Target Planting Date	Actual Planting Date
Beet	'Red Ace' (red)	50	July 15th	July 6th
	'Touchstone Gold' (yellow)	55	July 15th	July 6th
Carrot	'Bolero' (orange)	75	June 15 <sup>th</sup>	July 2nd
	'Jaune du Doubs' (yellow)	78	June 15 <sup>th</sup>	July 2nd
Rutabaga	'Laurentian'	95	June 1 <sup>st</sup>	June 15th
	'Helenor'	90	June 1 <sup>st</sup>	June 15th

All crops were planted with an older model (unknown) push-type *Planet Jr.* seeder. To estimate potential planting density, the seeder was spun the equivalent of nine linear feet prior to planting and seeds dropped were counted. Stand counts were made by selecting three, five ft row samples within each variety using a random number generator and counting emerged plants approximately 3 – 5 weeks after planting.

Estimated seeds planted for rutabagas were 10.2 and 15.1 seeds per ft for 'Helenor' and 'Laurentian', respectively. Stand per foot for rutabagas averaged 0.9 and 0.7 plants per foot for 'Helenor' and 'Laurentian', respectively. Estimated seeds planted for carrots were about 20 seeds per foot for both 'Bolero' and 'Jaune du Doubs'. Stand per foot for carrots averaged 3.9 and 13.2 plants per foot for 'Bolero' and 'Jaune du Doubs', respectively. Estimated seeds planted for beets were 22 and 39.7 seeds per ft for 'Red Ace' and 'Touchstone Gold', respectively. Stand per foot for beets averaged 2.4 and 1.1 plants per foot for 'Red Ace' and 'Touchstone Gold', respectively.

Table 2. Storage crop varieties with estimated planting population, stand count, vigor and canopy dates.

Crop	Variety	Est. Seeds Planted per Row Ft.	Plants per Ft After App. One Month	Visual Vigor Rating *	Canopy Date (days)
Beet	Red Ace	22.0	2.4	Good	Aug. 10 (35 d)
	Touchstone Gold	39.7	1.1	Poor	Never
Carrot	Bolero	20.6	3.9	Moderate	Aug. 30 (59 d)
	Jaune du Doubs	20.6	13.2	Good	Aug. 9 (31 d)
Rutabaga	Laurentian	15.1	0.7	Good	July 11
	Helenor	10.2	0.9	Good	(30 d)

\*Vigor was rated as Good, Moderate or Poor.

At harvest, crops were removed from the field, washed to remove excess soil, then sanitized in peroxyacetic acid (Tsunami 100, *Ecolabs*) before being bagged into 1.5 mil food grade polybags. All crops harvested were marketable and in good condition. Harvest of each crop occurred over time to obtain the 100 lbs needed for storage, except for carrots which were harvested en mass. The time period needed to obtain 100 lbs of each crop variety and the last harvest from the bed of crops are found in Table 3. Yield per foot row of 'Red Ace' and Touchstone Gold' were 1.39 and 0.28 lbs, respectively. Yields for 'Bolero' and 'Jaune de Doubs' were 0.82 and 0.39, respectively. Yields for 'Laurentian' and 'Helenor' were 0.30 and 0.66, respectively.

Table 3. Storage crop varieties harvest dates and yield.

Crop	Variety	Harvest Window for 100 lbs	End of Absolute Harvest Window	Total Yield (lbs) per Ft Row
Beet	'Red Ace' (red)	Sept 9 <sup>th</sup> through Oct. 3 <sup>rd</sup>	Oct. 10th	1.39 <sup>a</sup>
	'Touchstone Gold' (yellow)	Oct. 3 <sup>rd</sup> through Oct. 10th	Oct. 10th	0.28 <sup>a</sup>
Carrot	'Bolero' (orange)	Oct. 15	Oct. 15	0.82 <sup>b</sup>
	'Jaune du Doubs' (yellow)	Oct. 15	Oct. 15	0.39 <sup>b</sup>
Rutabaga	'Laurentian'	Aug. 29 <sup>th</sup> through Oct. 10th	Oct. 10th	0.30 <sup>c</sup>
	'Helencor'	Aug. 29 <sup>th</sup> through Sept. 16th	Oct. 10th	0.66 <sup>c</sup>

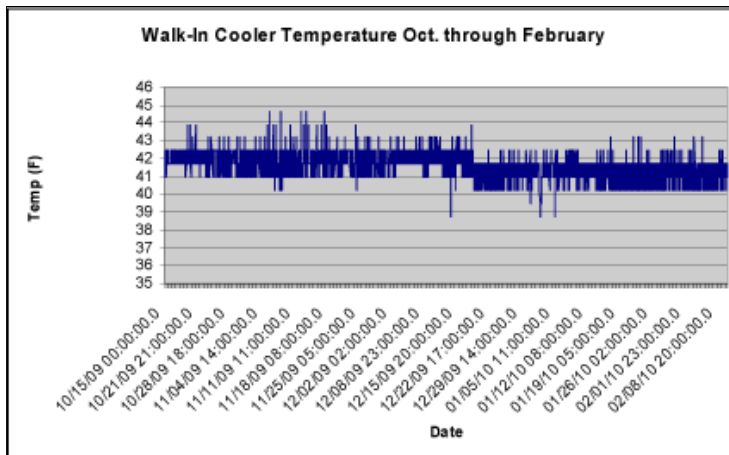
a Based on 99 ft (2 rows of 49.5 ft) for each beet variety. Only 27.5 lbs 'Touchstone Gold' were harvested.

b Based on 150 ft row for 'Bolero' and 300 ft (2 rows of 150 ft) for 'Doubs'

c Based on 300 ft (2 rows of 150 ft)

**Store crops in existing, under-utilized facilities**

Rutabagas, beets and carrots were stored in our walk-in cooler (Heatcraft compressor, Americooler 8' x 12' x 8' urethane construction). The cooler remained operational through February to record temperature and humidity. Specific humidity readings were deemed unreliable and are not reported. The Figure below shows interior cooler temperature readings from Oct. 15 through Feb. 8<sup>th</sup>. Temperatures consistently remained within a two degree Fahrenheit range.



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**Monitor quality and life of chosen crops**

Stored crops were monitored for marketability during the storage period. Storage problems leading to non-marketability were recorded. At 40 days stored, the yellow carrot 'June de Doubs' was the only crop beginning to lose its condition, but not to the extent of becoming unmarketable. At 50 days stored, 'June de Doubs' had only marginal marketability. At 60 days stored, only 'Bolero' carrots remained in good condition. Both rutabagas were sprouting heavily, although they remained firm. 'Red Ace' beets had initiated sprouting and had high surface mold where tops had been trimmed (Table 4).

Table 4. Storage crop varieties and conditions during storage.

Crop	Variety	40d	50d	60d
Beet	'Red Ace' (red)	Good.	Some surface mold. Easily cleaned.	90% surface mold. 10% sprouting from tops.
	'Touchstone Gold' (yellow)	Good.	Some surface mold. Easily cleaned.	Some surface mold. Easily cleaned.
Carrot	'Bolero' (orange)	Good.	Good	Good.
	'Jaune du Doubs' (yellow)	Small amt. surface mold on tips and small amt. sprouting. Easily cleaned.	Moderate amt. surface mold on tips and moderate amt. sprouting.	Moderate amt. surface mold on tips and moderate amt. sprouting. Rust colored spots on surface. Low marketability.
Rutabaga	'Laurentian'	Good.	Good.	Beginning to sprout.
	'Helenor'	Good.	Good.	Beginning to sprout.

### Record popularity and ease of marketing of storage crops in off-season environment various market outlets

Beginning Nov. 10<sup>th</sup> and ending Dec. 7<sup>th</sup>, we offered the marketable storage crops into three of our traditional markets, a local grocery cooperative, a local food collaborative and a producer-consumer local food cooperative. We recorded sales at each market location by crop (and variety) and price. The average price obtained by the farm for 'Red Ace' and 'Touchstone Gold' beets per lb was \$1.44 and \$1.76 from July through Oct., respectively. The average price obtained by the farm for stored 'Red Ace' and 'Touchstone Gold' beets in the off-season was \$1.30 and \$1.36 per lb., respectively. The average price obtained by the farm for 'Bolero' carrots per lb was \$1.29 from July through Oct. In Nov. and Dec., the average price per lb. of stored carrots rose to \$1.55 and \$1.47, respectively. The average price per lb obtained by the farm for 'Jaune du Doubs' carrots was \$1.70 from July through Oct. In Nov. and Dec., the average price per lb. of stored carrots fell to \$1.22 and \$1.40, respectively. Stored rutabagas averaged \$1.24 per lb. There were no rutabaga sales apart from the storage experiment to compare (Table 5). Rutabagas were a new crop to the farm in 2009 and only were planted for the demonstration project.

Table 5. Storage crop prices.

Crop	Variety	Ave. Price/Lb July-Oct.	Ave. Price/Lb Nov. (Stored)	Ave. Price/Lb Dec. (Stored)
Beet	Red Ace (red)	1.44	1.30	na
	Touchstone Gold (yellow)	1.76	1.36	na
Carrot	Bolero (orange)	1.29	1.55	1.47
	Jaune du Doubs (yellow)	1.70	1.22	1.40
Rutabaga	Laurentian	na	1.24	na
	Helenor	na	1.24	na

### Discussion

Small Potatoes generally finishes marketing and delivering of crops by the end of October or first week of November. Prior to 2009 we had not planted crops in any substantial amounts specifically to be stored post-season and sold during November or beyond. We felt doing this might be a strategic way to expand our marketing season. We concluded our farming system could benefit from marketing post-season storage crops. Benefits would be more likely by planting those crops at the proper time, selecting the right combination of crops and marketing the proper amount of those crops

Harvesting, processing and storing of the root crops for winter marketing was incorporated into our regular season labor regime. No additional hired labor was needed to market and deliver the roots during November or December. We did not have infrastructure expansion associated with the expanded marketing season, such as underground storage, since we used our existing walk-in cooler. Through this demonstration, we concluded the cooler would maintain a near constant temperature and provide adequate storage to high humidity/low temperature storage vegetables. Cost associated with keeping the cooler on amounted to approximately \$1 per day. Although not part of this project, it should be noted that cabbage kept very well in the cooler through January. Other crops reported to store well under this temperature/humidity regime are turnips, parsnips and kohlrabi.

In 2009, the fall and early winter were particularly mild, resulting in crop production and field harvesting much later than normal. We harvested and stored some additional crops long after we did the same for the crops in this demonstration. Not surprising, the latest harvested crops kept longest in the walk-in cooler, even allowing for delivery in January and early February. In this demonstration, carrots planted the first week of July matured at mid-October, an optimum time frame for storage. Beets and rutabagas would have benefited from a later planting and subsequent later harvest date. Rutabagas in particular matured much earlier than expected based on their published 'days to harvest'.

One strategy to maximize the quality and quantity of storage crops would be to continue to plant late into the growing season as if every year were to be unusually mild. Those years an extra storage crop can mature and be marketed will more than cover the cost of seed and planting in those years the last crops freeze prior to harvest. Interestingly, in 2009 at the farm, a bed of spinach and a bed of cilantro were planted on Sept. 5<sup>th</sup>. Although either failed to mature to harvest, both overwintered and were harvestable very early in the spring. This was in part due to the unusually long snow cover, but overwintering crops may be another tool to extend the marketing season.

Cool season crops planted in the summer for fall storage may have establishment difficulties. Average rainfall during this time period will be less than if these crops were spring planted. In this demonstration there was high variability in emergence and stand. High July temperatures and insufficient moisture at planting may have been a significant factor for this. For all these reasons, it may be beneficial to provide supplemental water for germination and emergence if necessary.

Plant vigor was a visual and somewhat subjective observation, but was based on the height of the crop compared to the weed height in the planting. Canopy dates were days from planting date until the crop leaves shade at least 80% or more of the soil between rows. In organic systems such as ours, agronomic properties such as vigorous emergence and time to canopy are necessary to make the crop economical, even if their storage properties are outstanding. Fast summer weed growth can overcome young seedlings very quickly.

Marketing storage crops off-season allows for expanded cash-flow and better utilization of labor resources only if the storage crops are demanded by the marketplace. If demand is furthered by scarcity of local produce during off-season, price premium may also be possible. It was found that popular seasonal crops were also the popular off-season crops. Carrots were more demanded than beets. Beets were more demanded than rutabagas. Focusing education on the benefits of winter seasonal eating should help demand of all crops that can be easily stored for winter consumption. The standard orange carrots variety, 'Bolero', had superior agronomic characteristics and was a better competitor in the marketplace than its yellow counterpart, 'Doubs'. This was also true for the standard red beet, 'Red Ace', when compared to 'Touchstone Gold'.

Contrary to our expectations, farm prices generally softened for the same crops into November and December (Table 5). The exception was orange carrots, which saw an increase in farm prices. As mentioned previously, it was an exceptionally mild fall and there was relatively more local produce available for sale during 'off-season' months. Another possibility is we may have saturated our markets. Our markets primarily consist of finite numbers of individuals and families. It is certainly true we began selling more bulk storage crops in November and December. Bulk sales are discounted and did bring down average farm prices received. Even though we did not receive premium prices for storage crops in the off-season, we did receive fair prices and captured new revenue we previously did not have.