Overwintered Brassica Production in Low Tunnels: Evaluating Planting Date and Species

Note: text editing done, photos entered but need formatting. 12/2/14

INTRODUCTION

In response to increasing demand for local vegetables, growers are extending their production into the colder months. Low tunnels are one cost-effective option for prolonging the fall harvest season until just prior to snow cover, as well as for growing hardy crops for early spring harvest. These temporary, unheated structures afford less winter protection than the more widely used high tunnels, and are inaccessible after the ground freezes. However, low tunnels provide sufficient winter protection for hardy fall-planted crops to survive and regrow, speeding up spring harvest by 4-5 weeks compared to spring-planted crops. Low tunnels can be erected for under $1.00 per square foot of usable bed space, estimated to be 5% of the cost of a 4-season greenhouse (Coleman 2009) or 15-30% of the cost of an unheated tunnel (Sideman). They offer the advantage of being moved annually, allowing rotation of winter production areas. In this trial we explored the potential for production of overwintered brassica greens under low tunnels, targeting March and April harvest dates. Brassicas are biennials, with leaf production concentrated in the first season, and the reproductive phase triggered by vernalization and occurring in the second season. The challenge of harvesting after overwintering is to maximize leaf production prior to the onset of bolting, the development of the elongated stalks that bear flowers. We evaluated the effect of fall planting date and brassica species on bolting, yield and quality.

Figure 1. Transplanted Siberian Kale on plastic, 3 plant dates, October 2011 after a late October snowstorm

METHODS

The experiment evaluated cold-hardy varieties from three brassica species: Siberian Kale (SK) (*Brassica napa*), a Mizuna-Tatsoi-Maruba (MTM) cross (*Brassica rapa*), and mixed red and green Mustard (MM) (*Brassica juncea*). We used varieties that were originally grown, overwintered and selected for hardiness and productivity by Brett Grohsgal (Even Star Organic Farm, Lexington Park, MD 20653), and had overwintered and produced seed at the UMass Research Farm for two previous winters. Greens were seeded in the greenhouse on three dates, and transplanted at corresponding dates (see Table 1, below).

We established 100' long low tunnels over 5' raised beds covered with black plastic mulch. Our hoop system consisted of 10' electrical conduit pipe shaped with a hoop bender (Johnny's Selected Seeds, Albion, ME) to be 5 ft wide at the base. Hoops were placed 5 ft apart over the

Table 1. Seeding, transplanting and harvest dates for Brassica low tunnel trial, UMass Research Farm, South Deerfield, MA, fall and winter 2011-2012

Planting #	Seed date	Transplant Date	Fall Harvest	Spring Harvests	
1	28-Aug	26-Sep	3-Nov	21-Mar	19-Apr
2	14-Sep	11-Oct	--	21-Mar	19-Apr
3	26-Sep	19-Oct	--	21-Mar	19-Apr

bed. A layer of 1.25 oz row cover (Dupont 5131) was applied on November 7, around the date of first frost, and a layer of 6 ml greenhouse plastic was added on December 13, 2011. Greenhouse plastic and row cover were removed for all trials on March 21, 2012.

Figure 2. Brassica rapa greens for low tunnel trial.

The first planting grew large enough for a fall harvest sample, taken on November 3. Spring harvest samples were taken on March 21/22 and on April 19. At times of harvest, we recorded % survival, % bolting, and marketable weights.

Figure 3. Siberian kale, *Brassica napa*, for low tunnel trial.

Figure 4. Mixed red and green mustard, *Brassica juncea*, for low tunnel trial.

100'long low tunnels were constructed of 10' electrical conduit at 5' spacing, on black plastic. Amanda Brown secured the end hoops and the ends of the plastic to a wooden stake at each end of the tunnel. October 2011.

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Figure 5. Mustard (left) and Siberian Kale (right) showed good spring regrowth and little bolting before covers were removed.

Growth prior to cover removal on March 13, 2012.

Figure 6. *Brassica rapa* greens (Mizuna-Mibuna-Tatsoi cross) werw100% bolted and flowering.

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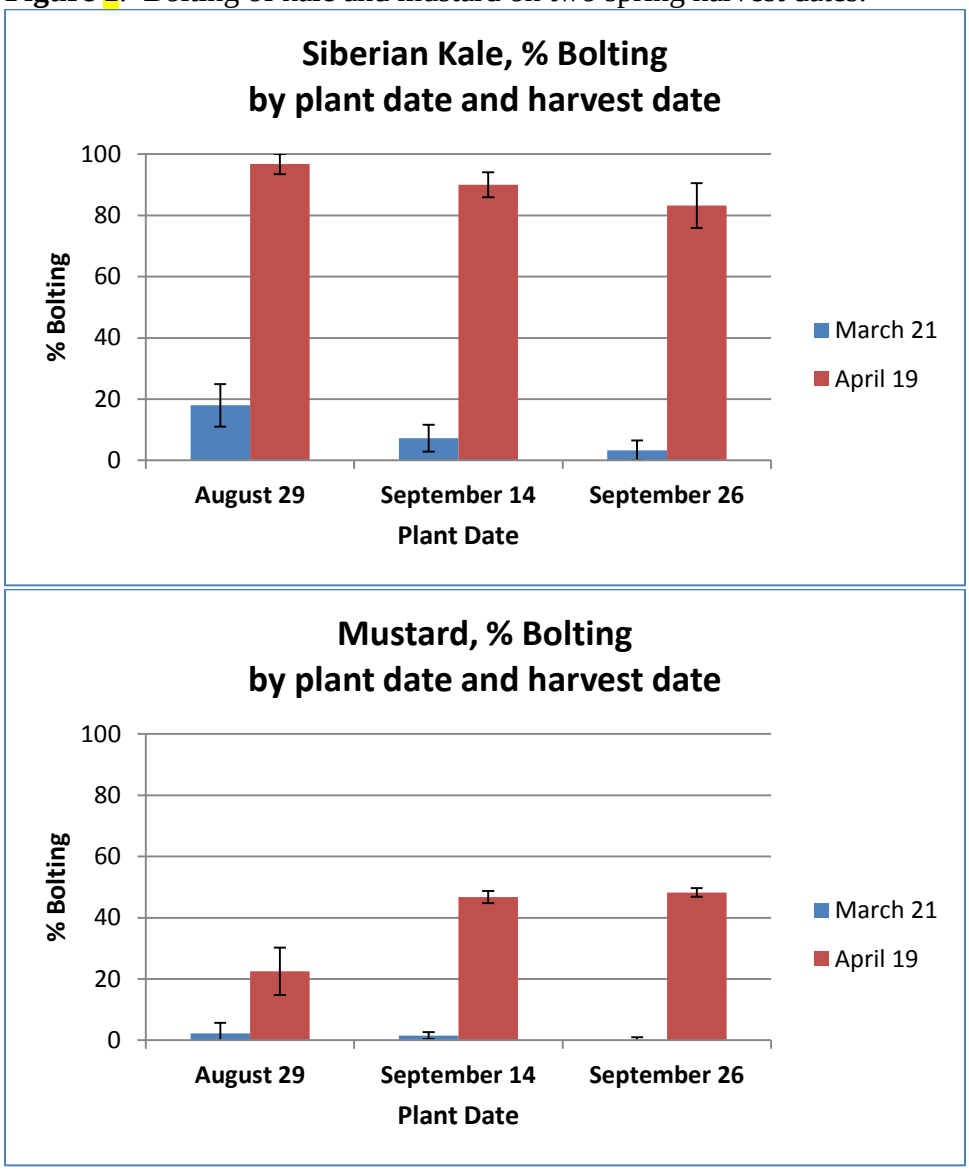
Figure 7. Kale (foreground) and *B. rapa* greens (beyond). First planting of kale is the largest.

RESULTS

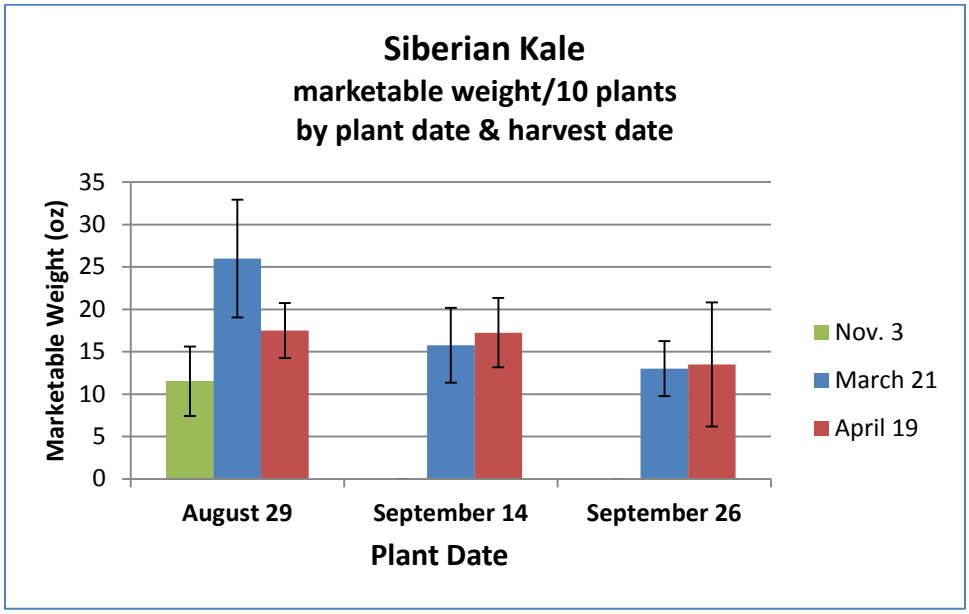
Survival and bolting. The *Brassica rapa* (MTM) bolted and flowered before covers were removed, making it unsuitable for commercial production. Spring harvest samples included only kale and mustard greens. Survival of overwintered plants was high, averaging 96% for kale and 92% for mustard. Survival was high across all planting dates, though slightly lower for the first planting date in mustard (average of 83%). In kale, about 10% of plants were bolting on the March 21 harvest, and 90% had bolted by the harvest on April 19. In mustard, the numbers were a bit lower, with only 1% bolted on March 21, and 39% by April 19. In kale, the early planting dates were the first to bolt, while in mustard, the opposite was true (see Figure 1 below). Only 23% of the August 29 planting of mustard had bolted by April 19, compared to about half of plants from the September 14 and 26 plantings.

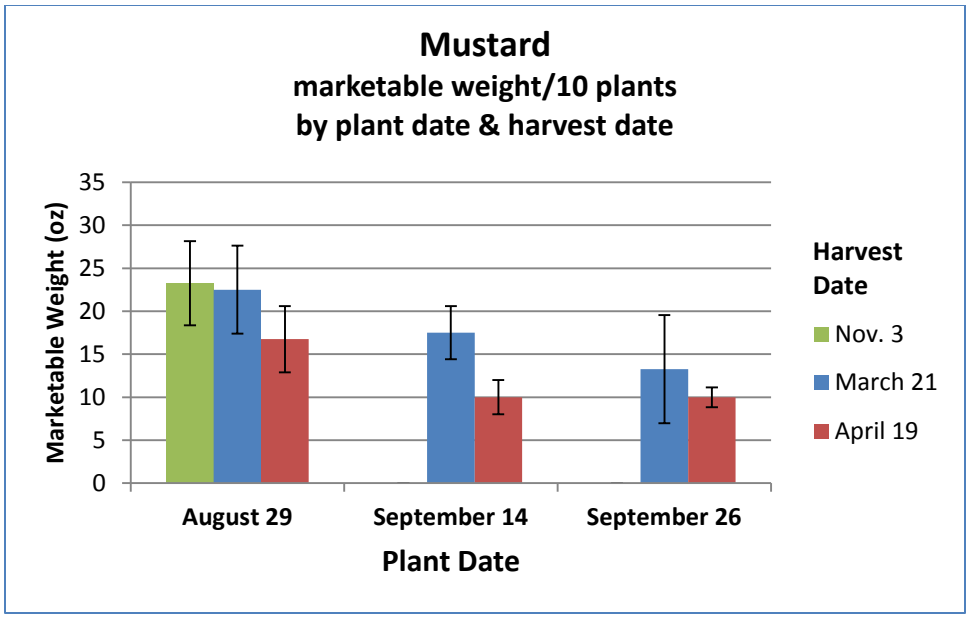
Figure 1. Bolting of kale and mustard on two spring harvest dates.



Yield. For all brassica species, the first planting produced harvestable leaves by early November. Harvest weights (oz.10 plants) averaged 16.5 for MTM, 11.5 for kale, and 23.3 for mustard. In spring, for kale and mustard, all three planting dates produced harvestable leaves for both harvests. The combined marketable weight from the two spring harvests was highest for the first planting date. Including fall and spring harvests, this meant that the first planting date (August 29) had much higher production of marketable greens than later plantings (Figure 2). For kale, the first planting date had total yield that was 1.7 times greater than the second planting date, and 2 times greater than the third planting date. For mustard, the first planting had a total yield that was 2.3 times greater than the second planting date, and 2.7 times greater than the third. Since bolting was so high at the third harvest, we did not anticipate it would be possible to get a fourth harvest in for any of the plants, even those planted later in the season. This suggests that if you do choose to plant in the fall, planting earlier will generate greater yield, even if in some cases it leads to higher rates of bolting in the spring.

Figure 2. Total harvest was highest for the first planting date in both kale and mustard.




Mustard
marketable weight/10 plants
by plant date & harvest date
Marketable Weight (oz)
35
30
25
20
15
10
5
0
August 29
September 14
September 26
Plant Date
Harvest Date
Nov. 3
March 21
April 19

Discussion and Lessons Learned

Tunnel management

An unexpected challenge occurred when the ground froze overnight on December 11, before the plastic cover was secured in place. Several methods including soil-filled bags and railroad ties proved no match for the strong winds in the fields at the research farm, which flipped off the plastic cover within a couple of days. Only the addition of cement blocks along with railroad ties secured the cover for the winter.

In spring, both plastic and row cover were removed on the same day (March 13), placing tender regrowth at risk of wind burn. Growth inside the tunnel occurs in a wind-free and low-light environment and greens need to be hardened off, which can be accomplished by removing plastic first, then row cover after a week or more, depending on weather conditions. This also reduces overheating which can easily occur in the plastic-enclosed tunnel on a cool, but sunny day or a warm spell in early spring. Fortunately, these crops appeared to be less sensitive to wind burn than spinach which was trialed under the same conditions.

Variety and planting date in relation to bolting and yield: The rapid bolting of *Brassica rapa* in this trial suggest that crops of this species are not suitable for overwintering in low tunnels. This result is consistent with grower observations in both low and high tunnels. However, the

August plant date produced harvestable yields by early November, suggesting that B rapa crops would be suited to low tunnels for late fall season extension. Among planting dates, the spring bolting response was opposite for *B napa* (Siberian kale) and *B. juncea* (mustard), suggesting that using planting date to manage bolting needs to be understood on a species by species basis even within the Brassica genus. For both kale and mustard, there was a window from early March to mid-April when regrowth of leaves was strong prior to bolting. A grower who is managing the crop for spring harvest might harvest earlier or more frequently during that period to gain optimum yields. There were good quality leaves in kale even when bolting was near 90% in kale on the April 19 harvest. In this study, the August seeding date showed the highest overall yields in both kale and mustard, with yields declining for later seeding dates.