VEGETABLE CROPS HOTLINE

A newsletter for commercial vegetable growers prepared by the Purdue University Cooperative Extension Service

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In This Issue

Indiana Vegetable Growers Seeks Board Members

The Indiana Vegetable Growers Association board is seeking board members for 3-year terms beginning at the annual meeting in February 2018. Members interested in serving, or with suggestions for potential members, should contact President John Young at jmyoungco@yahoo.com or 5028 E. Landersdale Rd. Mooresville, IN 46158. For more information about the IVGA visit ivga.org.

Downy Mildew of Cucurbits

(Dan Egel, egel@purdue.edu, (812) 886-0198)

Earlier in August, downy mildew was reported on all cucurbit species in LaPorte County in northwest Indiana and on pumpkins in Starke County (just south of La Porte County). More recently, downy mildew was reported on cucumbers and butternut squash in Knox County in southwestern Indiana. In addition, downy mildew is strongly suspected on cucumbers in Jefferson County. Growers in nearby areas should take care to manage downy mildew if they have valuable cucurbit crops. However, this late in the season, it is unlikely that there will be widespread losses. Management of downy mildew of cucurbits is discussed in the *Midwest Vegetable Production Guide for Commercial Growers 2017* mwveguide.org and in the extension bulletin Downy Mildew of Pumpkin https://www.extension.purdue.edu/extmedia/BP/BP-140-W.pdf. Note that downy mildew of cucurbits and downy mildew of soybeans are not caused by the same organism. Please call Dan Egel if you have questions or concerns.

Facts about Lettuce

(Wenjing Guan, guan40@purdue.edu, (812) 886-0198) & (Liz Maynard, emaynard@purdue.edu, (219) 548-3674)

Winter farmers markets are becoming more and more popular. Lettuce is a primary type of vegetables grown for the market. As we are finishing up summer crops, it is a good time to learn and refresh knowledge about lettuce. This article discusses some of the basics of growing lettuce in high tunnels, as well as the lessons we learned from a trial conducted at Southwest Purdue Ag Center in fall 2016.

Lettuce Types

Lettuce has multiple morphological forms major types include crisphead (iceberg), butterhead (bibb), romaine (cos), Batavian (summer crisp), and multi-leaf lettuce (salanova). The first decision about growing lettuce is whether to harvest full-size heads of lettuce, or to harvest 'baby-leaf' lettuce (Figure 1). These harvest methods require very different production practices. Full-size heads are harvested one time as a single head of leaves. Baby-leaf lettuce is first harvested when single leaves reach about 4 to 5 inches, and then re-cut multiple times in a season as new leaves grow. Harvesting baby-leaf lettuce is more labor intensive. In addition, growing baby-leaf lettuce demands greater care during and after harvest to maintain quality and safety. For harvest of full-size heads, romaine, butterhead, Batavian, and leaf lettuces are good choices for local, protected cultural production. Romaine and leaf lettuces are often grown for baby-leaf lettuce. Multi-leaf types are relatively new and have attracted a lot of attention in recent years (Figure 2). When harvested by cutting just above the growing point, the harvested leaves resemble baby-leaf lettuce. When harvested as entire heads, the end user can easily remove the core to create a mass of lettuce leaves ready for use.

Seed Germination

Germination of lettuce seeds is tricky since they may exhibit different types of dormancy. For example, many lettuce cultivars have varying levels of thermal dormancy that block seed germination when temperatures are above 75 °F. In addition, a few older heirloom cultivars may exhibit photo dormancy, which means they require light to germinate. Germination of these cultivars will be blocked if seeds are buried too deep in the soil. Germination of directly seeded lettuce in high tunnels in early fall

may encounter thermal dormancy. From our temperature recordings in a high tunnel at SWPAC in fall 2016, average soil temperatures did not drop below 82 °F until end of September. In this scenario, shade is needed to germinate directly seeded lettuce seeds if they were planted in August and most of the time in September.

Direct Seed or Transplant

Lettuce does not compete well with weeds. Whenever possible, use transplants to ensure a uniform crop. Transplants can be produced in 96 or 128 cell trays. With temperatures between 65 and 75 °F, it normally takes 3-4 weeks to grow transplants. Twelve-inch spacing within and between rows works well for romaine lettuce. Butterhead and leaf lettuce can be planted 6-8'' within the row and 8-12'' between the rows. Baby-leaf lettuce is usually direct seeded at very high densities, for instance, 60 seeds per foot in a band several inches wide.

Figure 1. Baby-leaf lettuce grown in a high tunnel (photo by Liz Maynard)

Figure 2. Multi-leaf lettuces grown in a high tunnel (photo by Liz Maynard)

Plant Growth

Optimum daily temperatures for lettuce growth are between 65 to 70 °F, with night temperatures in the range of 45 to 50 °F. Temperatures above 86 °F stunt plant growth, and result in bitterness. Temperatures below 45 °F slow down plant growth considerably. In fall 2016, average temperatures in the high tunnel at SWPAC were above 86 °F until about middle September and did not drop below 45 °F until middle December. Lettuce cultivars 'Green Forest', 'Tropicana', and 'Thurinus' that were planted on Sep 1, Sep 12, Sep 23 and Oct 7 took about 27-30 days from the dates of transplant to the dates of harvest. For seedlings planted on Oct. 21, it took about 42 days for plants to reach the comparable size. Seedlings planted on November 2 were severely damaged by freezing temperatures before they reached marketable size. The majority of the lettuce heads harvested from the trial had great quality, except the heads harvested from the first planting date (Sep 1) that tasted bitter. Our experience with winter production of head lettuce indicates that lettuce seedlings should be planted no later than the end of October in high tunnels in southern Indiana to ensure most growth is completed before temperature drops below 45 °F.

Freezing tolerance

If well hardened, lettuce seedlings can survive temperatures as low as 25 °F. In southern Indiana, maintaining minimal temperatures above 20 °F, in general, can be achieved with a layer of 3 oz/yd. row covers over the top of the beds inside high tunnels. It is, therefore, possible to grow baby-leaf lettuce throughout the winter in a high tunnel without heating. However, as lettuce approaches maturity, it becomes more easily damaged by freezing temperatures (Figure 3). It is less likely that one can grow high-quality head lettuce in winter months without the use of at least minimal heating in southern Indiana.

Figure 3. This Romaine lettuce was severely damaged by freezing temperatures

Yellow Leaves on Pumpkins

(Dan Egel, egel@purdue.edu, (812) 886-0198)

This time of year, I receive many complaints of pumpkin plants with yellow leaves. There can be many reasons why pumpkin

plants have yellow leaves. The most common reason for yellow pumpkin leaves doesn't have anything to do with a disease that can spread from plant to plant. Usually, the reason for the yellow pumpkin leaves has to do with lack of water, weather that has been too hot, nutrient deficiency or other stresses. The photos and discussion below will, I hope, illustrate my point.

Let's say you have a pumpkin field where you have pumpkin leaves that are yellow and you are wondering about the cause. You may want to ask yourself, which leaves are yellow and where are they yellow.

In Figure 1, yellow pumpkin leaves may be observed. When one looks a bit closer to find out where the yellow leaves are, one can see that the yellowing runs down the row. In fact, it is the older leaves that are yellow (Among plant biologists, we prefer the term chlorosis to yellow. But I will continue to use the word yellow here.) When older leaves are yellow and the younger leaves appear green and healthy, the reason for the yellowing is usually stress related-as indicated above. I am not too worried about this type of yellowed pumpkin leaves.

Figure 1. The yellowing of these pumpkin leaves seems to run down the row.

Look again at figure 1 to try out which part of the leaves are yellow. For the most part, the portion of the leaves that are yellow are the edges (or margins) of the leaves (Figure 2). One doesn't see entire leaves that are yellow. The yellowing doesn't appear in the interior of the leaves. Yellowing on the outside of the leaf normally means that the reason is stress related as discussed above.

Older leaves tend to become yellow with time because nutrients like nitrogen are mobile in the plant and will move to the younger leaves where they are needed. In addition, the edges of leaves may become yellow because the edges of leaves have pores where sap (known as the water of guttation by botanists) is secreted at night. This sap may have a mildly toxic effect on the leaves over time—this is the reason that the edge of older leaves may become yellow.

Figure 2. The edges of this pumpkin leaf are yellow, most likely due to environmental stress.

In figure 3, the yellowing of the pumpkin leaves is more generally over a larger area in contrast to figure 1 where the yellowing could be seen to run down a row. Most of the yellowing appears in the foreground of the photo in figure 3. If one looks down the hill, the leaves appear green and healthy. Now, let's look at the soil next to the symptomatic pumpkin leaves. The soil appears sandy.

Figure 3. This view is from the top of the hill looking down. The pumpkin plants in the foreground of this photos have yellow leaves. The soil is sandy at the top of the hill.

Next, we will walk down the hill where the pumpkin leaves are green and look back up toward the yellowed pumpkin leaves (Figure 4). Again, we notice that the area on top of the hill are in a general area—they don't seem to run down a row. That is, it isn't just the older leaves that are yellow. Now, take a look at the soil next to the green pumpkin leaves at the bottom of the hill. The soil is much heavier with more of a clay content than the soil at the top of the hill.

Figure 4. This view is from the bottom of the hill looking up. The pumpkin leaves at the bottom of the hill are generally green and healthy. The soil at the bottom of the hill is relatively heavy.

The lesson here is that the pumpkins at the top of the hill had much less access to water than the bottom of the hill. This is true both because hills tend to be better drained and because sandier soils hold less water. The grower had drip irrigation in place, but was not able to pump much water due to lack of water in a surface pond. Therefore, the yellowing leaves at the top of the hill is due to drought stress.

Both of the fields of pumpkins pictured here produced good crops. The yellow on the pumpkin leaves does not necessarily indicate a disaster or a disease is in the future.

I hope the photos and discussion presented here will help one to figure out what is wrong in one's pumpkin patch. However, if one still has questions about symptoms, it is best to send off a sample to a diagnostic laboratory. Purdue University's Plant and Pest Diagnostic Laboratory is an excellent resource https://ag.purdue.edu/btny/ppdl/Pages/default.aspx.

Cercospora Leaf Spot of Beet

(Dan Egel, egel@purdue.edu, (812) 886-0198)

This disease was observed in southern Indiana recently. Cercospora leaf spot affects table beets and swiss chard. Symptoms include circular leaf spots that may have a reddish margin. The center of the lesions may start off a light brown and turn to gray after the fungus (*Cercospora beticola)* begins to sporulate. Under conditions conducive to disease, the lesions can coalesce and result in loss of foliage. Yield and quality of the crop can be reduced.

Cercospora leaf spot is favored by rainy weather or overhead irrigation and temperatures from 77 to 95°F. The spores are readily dispersed in rainy, windy weather.

Resistant cultivars are available. Fall tillage and crop rotations of 2 to 3 years should help to lessen disease severity.

Several fungicides are listed in the *2017 Midwest Vegetable Production Guide for Commercial Growers* including copper compounds, some of which may be allowed in organic certifications.

Synthetic fungicides include: Products with the active ingredient chlorothalonil (e.g., Bravo®, Equus®, Initiate®); Cabrio EG®; Flint®; Fontelis 1.67 SC®; Merivon®; tebuconazole products such as Monsoon® and Onset®; Quadris® and Satori®; The *Midwest Vegetable Production Guide* has more information. Always consult the label before every pesticide application.

Figure 1. Cercospora leaf spot of garden beet causes bray/brown lesions with reddish margins.

Using Season-long Retractable Tunnels may Help Control Foliar Diseases and Improve Fruit Quality of Tomatoes

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Tomato foliar diseases such as early blight, Septoria leaf blight, bacterial spot and speck that are commonly seen in the field are often less common on tomatoes grown in greenhouses and high tunnels. It is also true that high tunnel tomatoes have smoother skins than tomatoes grown in the fields. An important factor that determines this difference is rainfall. Pathogens that cause foliar diseases require leaves to be wet in order for infection to occur and rely on rain for spread. In addition, heavy rains cause tomato physiological disorders such as rain check. It is great that greenhouse and high tunnel structures prevent tomato canopies from direct exposure to rainfall, however, a significant initial investment is required for building the structures, and it is hard to relocate them after they are built.

This summer, we used a retractable tunnel to grow tomatoes and peppers in the field (Figure 1). The tunnels are 5' tall, covered with plastics that have perforated holes on the sides. Edges of the plastic are not buried into soils as most low tunnels do. Instead, the plastic can be pulled up or down on both sides. Hoops are placed 5' apart and connected with tomato stakes. Elastic rubber bungees are used to keep the plastic on the hoops.

Figure 1. Tomatoes are grown under a retractable tunnel system.

We used the tunnels to grow tomatoes and peppers all season-long. The design is effective in keeping canopies dry when it rains if the sides are pulled down. When the sides are pulled all the way up, there are no clear differences in terms of temperature and relative humidity under the tunnels. Foliages of tomato plants grown under plastic seem to have less necrosis than those of plants exposed to the rains. But with a relatively dry season, we did not see a clear advantage of using the tunnels to improve crop condition. More years of observations are needed. Cost of the structures is about one-third of the cost of high tunnels. The structures are very easy to move. Except for the plastic, other parts of the structures can be used for many years. It should be noted that the retractable tunnels have little effects in enhancing temperatures in the early season. If you are interested in learning more about the retractable tunnel, please contact Wenjing Guan at guan40@purdue.edu.

What You Need to Know about Selling in Farmers Markets—Let's Talk about Prices

(Allan Pinto, pinto7@purdue.edu) & *(Ariana Torres, torres2@purdue.edu)*

This publication is the second part of a series of publications that aim to help farmers selling at farmers markets and other local markets. Below we offer information on price determination and pricing strategies for farmers markets.

The importance of understanding pricing information

Pricing is probably the single most important driver of farm profitability and long-term sustainability; yet it tends be one of the least controlled factors by farmers. The price that you tend to set for their produce represents the monetary value of a product. In economic terms, price reflects how much the consumer values your produce, which depends on internal (produce quality, the farm's image, production yield, credit terms) and external (competitors, consumers' preferences, seasonality) factors.

A study by Darby et al. (2008) found that consumers prefer locally grown over regional or U.S. grown, and are willing to pay almost twice as much for local products. For example, data from our project shows that consumers paid $3.95 for a pound of slicing tomatoes at the Lafayette farmers market in July; but according to reports from the USDA-AMS a pound of slicing tomatoes was sold for $1.99 in retail markets during the same period (USDA-AMS, 2017); a 98% increase in price.

Information about pricing is generally available for growers with enough volume to enter wholesale markets. For example, the USDA-AMS publishes wholesale and retail prices of fruits and vegetables weekly on the Market News website. Growers selling wholesale can access these weekly reports to overcome risk and uncertainties and save time and money when accessing markets.

By contrast, Indiana farmers who sell in farmers markets and other local outlets lack this kind of information. Many farmers who sell locally usually define their prices by walking down the market aisles of farmers markets, then setting prices based on other vendors' prices. The lack of pricing and sales information not only increases risk, it also limits ability to assess farm profitability, evaluate price and marketing strategies, determine the market window for specific crops, choose market channels, and evaluate market feasibility for new crops. The Purdue University Horticulture Business extension program has recently begun collecting prices from eight Indiana farmers markets and publishing price points for fruits and vegetables.

Benchmarking (the practice of analyzing competitors' prices and products) helps farmers understand and assess a pricing strategy. Observing price points from competitors can help understand how prices, and potential profitability, may affect success. Some of the benefits of observing farmers markets price points are:

- Analyzing if market prices are enough to cover production and administrative costs while providing enough money to make a living.
- Finding profitable marketing strategies that may work for a specific crop or market location.
- Evaluating if valued-added strategies may help receive price premiums.

How to price produce for market

Information about price setting strategies is one of the most frequent requests among farmers who sell directly to consumers. If you are one of those farmers, you know that determining produce prices is up to you. Does it depend on your production and administrative costs, profitability goals, market prices, or costumers' preferences? The answer is all of the above.

Below we offer some pricing strategies to help farmers set prices for their produce. Keep in mind that the ideal price is the one that intersects your profitability goals with the value customers place in the produce. While it may be easier to charge the same as other vendors, it is important to understand your production costs and have an idea of the value customers place on your produce before setting prices.

Quantifying total production costs and selling above those costs is one of the main strategies in effective pricing. Ideally, growers keep records of revenues and expenses and determine their costs of production for each crop. However, new growers may not have price records or pricing information to estimate production costs. If your costs are unknown, several university extension services have published enterprise budget tools to help

you estimate the costs and returns to produce a product. The Horticulture Business website is currently building a HortBusiness Calculator to assist Indiana fruit and vegetable farmers building their enterprise budget.

An enterprise budget lists all estimated income and expenses associated with a specific enterprise to provide an estimate of its profitability. For example, if the total cost of producing a pound of tomato is $0.79 and the tomatoes are sold at $2 per pound at the farmers market, farmers will be able to know that $1.21 is the profit margin per pound of tomato, and estimate if this is enough money to achieve their profitability goals.

Farmers must also know the value that buyers place on their produce and set fair prices, enough for being both profitable and competitive. Being customer-oriented means that farmers are in tune to the customer's psychological and economic motivators. For example, customers tend to place higher value for fresher, better looking, pre-washed and pre-cut, new or specialty varieties, or organic produce.

Price-setting strategies for farmers markets

Below are a few price-setting strategies to help farmers set produce prices:

Pricing for profit means setting prices above the total costs. If farmers know their total costs (that is, the sum of pre-planting, harvest, post-harvest, labor, fuel, administrative, and marketing costs per unit of produce), then farmers can use the pricing for profit strategy. Any price set above the sum of the total costs per unit of produce will contribute to the farmer's profitability. This strategy is also called cost plus pricing. The main advantage of this method is its simplicity, because if you are able to properly calculate your total costs, then computing the final selling price is relatively easy. An enterprise budget can help you on this task.

Odd pricing is typically used by business managers who set prices that end in odd numbers: typically 5, 7, or 9. The idea is that customers may perceive that a produce sold for $2.99 appears to be significantly more attractive than one sold for $3.00. Figure 1 illustrates an example of odd pricing vegetables for zucchini in a farmers market.

Figure 1. Odd pricing used by farmers selling at the Lafayette (Indiana) Farmers Market.

Bundling is the strategy of grouping together several products into a package that offers customers extra value at a special price. Bundling helps farmers highlight and sell unique produce that customers cannot find in a supermarket. Figure 2 illustrates an example of bundling vegetables for stir-fry.

Figure 2. Bundling stir-fry vegetables at the West Lafayette (Indiana) Farmers Market.

This article illustrates the different pricing strategies for produce sold at this or other local markets. Farmers can find more information about these strategies and more on the Purdue Extension Horticulture Business website.

References

Darby, K., M.T. Batte, S. Ernst, and B. Roe. 2008. "Decomposing local: a conjoint analysis of locally produced foods." American Journal of Agricultural Economics 90(2):476–86.

USDA-AMS. 2017. Specialty Crops. www.ams.usda.gov/market-news/fruits-vegetables.

Upcoming Events

Hydroponics Workshop II

Date: Sep 8, 2017, 7:30 am – noon.

Location: WSLR 116, Horticulture & Landscape Architecture 170 S. University St. Purdue University West Lafayette, IN 47907

Registration: http://tinyurl.com/yb4dnwrh For further questions contact Lori Jolly-Brown, ljollybr@purdue.edu, (765) 494-1296

In this workshop, you will learn about:

- LED lighting for winter produce in greenhouses
- Things to know about successful production in 'vertical or indoor farms'
- Biological control of insects
- Fertilizer recipes and injectors
- Ongoing research in our greenhouses

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Beginning Farmer East Regional Workshop

Date: Oct. 28, 2017, 8:30 am – 4 pm.

Location: Randolph County Fairgrounds, 1885 U.S. Route 27, Winchester.

Attendees for this workshop can learn about:

- Business planning
- Pasture management
- Fruit and vegetable pest management
- Pastured poultry
- Greenhouse and high tunnel management
- Marketing products

Purdue Extension experts will be available to discuss and answer questions. Cost is $10 and lunch will be provided. **To register** or find more information about the next four regional workshops, go to www.conf.purdue.edu/BegFarmerTours.

Midwest Mechanical Weed Control Field Day

Date: Sep 26, 2017, 10:00 am – 5:00 pm

Location: Michigan State University Horticulture Teaching and Research Center – 3291 College Rd, Holt, MI 48842
Registration: The fee for the field day and lunch is $15. Register before September 15th. More information and Registration of the field day is available at http://msue.anr.msu.edu/events/midwest_mechanical_weed_control_field_day

Second National Conference on Cover Crops & Soil Health

Date: Dec 7-8, 2017

Location: Sheraton Indianapolis at Keystone Crossing, 8787 Keystone Crossing, Indianapolis, Indiana 46240, USA

The conference is intended for anyone interested in the practical use of cover crops and soil health improvement, including farmers; conservation agents; certified crop advisers (CCAs) and agribusiness staff; and university, nongovernmental organization (NGO), and agency representatives.

Headliners for the conference include:

- Keith Berns, a nationally known Nebraska farmer on the topic of carbonomics
- David Montgomery, a geologist and popular author on soils and erosion, whose latest book is titled *Growing a Revolution: Bringing Our Soil Back to Life*
- Dan DeSutter, a grain farmer from the central Corn Belt and a long-time no-tiller and cover crop user
- Trey Hill, a grain farmer from the eastern Corn Belt and also a long-time no-tiller and cover crop user
- Jimmy Emmons, a rancher and grain farmer from the Southern Plains, who grazes cover crop

More information about the conference and registration is available at http://www.swcs.org/en/conferences/2017_national_conference_on_cover_crops/

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