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Cover crops and pollinators

by James Quinn

James Quinn and Pat Byers in a fall cover crop of buckwheat.

It seems everywhere you turn, these two keep popping up. The August edition of *American Vegetable Grower* discussed cover crops in the 'Sustainable Solutions' column (page 16) and closed out with their last page editorial "Save the Pollinators". Where might growers turn for quick and quality information on either of these topics? Try the *Midwest Vegetable Production Guide for Commercial Growers*!

The 2016 edition added examples of how to sequence cover crops with vegetable crops, in the Soils and Fertility section (pages 20 & 21). Five examples are provided, of vegetable crops in a field for a 4-year period. So this provides about 20 examples to look at for rotation ideas. Just following these rotations on page 22 the guide provides a table on green manure crops for vegetable farms, where seeding rates are provided and the preferred seeding dates.

The sections of the guide addressing bees, pollination and pesticides (pages 29-31) are fairly general, but do provide some good tips. Table 10 does provide specifics on the toxicity of the different insecticides.

Also gaining in interest is 'soil health', all the factors that one might want to consider regarding it, and specifically considering physical and biological factors beyond what a typical soil test uses. Please note the article that delves into this subject.

Announcements

Central Missouri Produce Auction will have their annual business meeting on Friday, December 2nd. No RSVP is needed. It will start at 9 AM and finish about 3 PM. For those unfamiliar with this event, there is educational programming for the morning and part of the afternoon. Separate rooms are generally used for field vegetable production and greenhouse topics. It was not held last year, as they wanted growers to attend the Western Produce Auctions Annual Meeting which was held nearby the Four County Produce Auction (Windsor, MO).

Great Plains Growers Conference will be offering a new training on food safety. It will be on Thursday, January 12, 2017. The FSMA 'Grower Training' is for fruit and vegetable growers and others interested in learning about produce safety, the Food Safety Modernization Act (FSMA) Produce Safety Rule, Good Agricultural Practices (GAPs), and co-management of natural resources and food safety. The PSA Grower Training Course is one way to satisfy the FSMA Produce Safety Rule requirement. This requires 'At least one supervisor or responsible party for your farm must have successfully completed food safety training at least equivalent to that received under standardized curriculum recognized as adequate by the Food and Drug Administration.' This training will undoubtedly be offered around the state in 2017 and beyond. Nonetheless, this is the first opportunity to take it. The cost is $95. For more information call 816-279-1691 or visit: www.greatplainsgrowersconference.org

In This Issue

Japanese beetles plagued some parts of rural Missouri in 2016. What's their outlook?

by Pat Miller, Agronomy Specialist

In 1934 Japanese beetles made it to St. Louis, after being accidently introduced in the U.S. in 1916. They have migrated across much of the state with some areas having extremely high numbers. These beetles are scarce in north Missouri but heavy in the southwest and central areas of the state (note Table 1). Kansas City is typical of north Missouri, and for some reason in the Southeast, despite the weather being favorable, they don't seem to have become as troublesome.

If you don't have them now, you may expect them in the future. They feed on quite a variety of vegetables, such as beans, asparagus stems, the foliage and silk of corn and the foliage of okra. Heavy clipping of corn silks will keep the corn from setting kernels. They also feed on rhubarb, grape, raspberry, elderberry and blackberry, some tree fruits, and hundreds of ornamental plants and trees. Commercial traps are available and will help alert you to their presence when they are first coming into your area. Grapes are such a preferred food that beetles feeding on wild grapes might be an early indicator of their presence. Grubs, the larvae of the beetles, feed on the roots of corn, beet, beans, asparagus, tomato and onion, as well as many grasses. Japanese beetles overwinter as a partially grown grub in the soil below the frost line. After pupating in the soil the adult emerges in early summer. Feeding activity lasts four to six weeks. They mate after emerging and lay eggs in the soil, usually in grass, where they hatch in mid to late summer. Larvae feed on roots until the soil cools in the fall.

Table 1. Peak trap count- single day of Japanese beetles, for selected Missouri locations 2012-2016.*

Location	Year				
	2012	2013	2014	2015	2016
St. Louis area	1040	35	500	70	375
Southwest (Lamar)	5200	385	1550	7280	5740
Springfield	400	60	125	470	4500
Jefferson City	3800	95	1000	2150	5200
Southeast	114	5	42	13	45
Kansas City	7	9	9	19	50

** Source of data is University of Missouri's Integrated Pest Management program, from the 'Pest Monitoring Network'. ipm.missouri.edu/pestMonitoring*

After several years of extremely high numbers, the populations may drop and stabilize at lower numbers due to natural controls (note in Table 1, the St. Louis counts). Climatic occurrences that harm natural controls will cause the population to rebound. Beetle populations have been lower in the years following a severe drought but will rebound (note in Table 1, drop from 2012 to 2013, and increase in following years). A number of insecticides are labeled for their control but control is made difficult because the continued emergence over several weeks. Neem oil has been reported to have some repellent activity. Always follow the label when using pesticides. Most have pre-harvest restrictions. Trapping may attract more than it kills so unless you are doing mass trapping to reduce numbers, place the trap away from produce and landscaping areas.

For more information, see The Japanese Beetle fact sheet at www.lincolnu.edu/web/programs-and-projects/ipm

Ediitor's note:

I posed this question to some of my colleagues to the east, where Japanese beetles have been around for a couple of decades.

"We are experiencing some initial years of infestation. Folks out in the country got a bit distressed…..maybe they were just really bad this year. But this was typical of some calls:

The Japanese beetles have almost formed a swarm and ate most of the upper leaves of a large elm tree. What is going on with them this year and will it kill my tree? Can anything be done?"

Here was an excellent reply:

"The St Louis Metro East experienced the worst of the Japanese Beetle front in the early 2000's… particularly in Clinton County where we had a lot of dairy. You would be driving along and see this black cloud-like haze, which turned out to be a large group of Japanese beetles…like being inside a large popcorn popper when driving through. I have not really even thought about Japanese beetles for at least the last 8 years… just have not been at levels that have been problematic. Levels have gradually leveled out to where they can be found but not at devastating levels."

Dr. Elizabeth Wahle, Ph.D.
University of Illinois
Extension- Horticulture

Interested in improving soil health?

Suggestions were provided to improve the four characteristics presented with the soil health assessment report. Several of suggestions were mentioned three or four times, such as:

- Decrease tillage/disturbance
- Add manure, compost, or mulch
- Keep vegetation growing year-round
- Use double cropping
- Plant cover crops
- Add perennial crops (e.g. pasture or hay) to the rotation
- Add wheat or other small grain to rotation

Soil health under study in Missouri

by James Quinn and Donna Brandt*

Most growers realize the value of a typical soil test, especially to determine fertilizer to apply. And there is some indication available with these results on other physical characteristics (e.g. % sand, silt and clay). More understanding of soil can be obtained thru 'characterization' which deals with the physical and chemical properties of soil. However, it does not typically address the biological component. Since around 2010, interest in the biological component of soil has grown rapidly and this more holistic approach to the study of soil has been encompassed under the umbrella of Soil Health.

Last summer a program was initiated between the county based Soil and Water Conservation Districts and a new lab at University of Missouri (Soil Health Assessment Center), whereby comprehensive testing occurred across the state. Farmers took field samples and submitted them for testing, with the costs offset by conservation funds. (Funds provided by the Missouri Parks and Soils Tax and overseen by the Missouri Department of Natural Resources). This occurred throughout the fall of 2015 and November 2016, the results are being shared. This article is to discuss some of those results, highlighting four tests that are likely of most interest, and to share the results from specific counties in which some of the auction growers farm.

Each sample submitted received a report with over 15 separate test results, too many to discuss here. The four that seemed most relevant or of interest to a produce grower are:

- total organic carbon (TOC)
- active carbon
- bulk density
- water stable aggregates.

The test for total organic carbon (TOC) is more carefully and accurately obtained than the 'organic matter' one gets with a typical soil test. But it can be roughly compared to soil organic matter with TOC being about 60% of typical organic matter. Most growers know more organic matter is better, that with higher amounts nutrients cycle better, more water is retained, and the environment is improved for microbes. Both organic matter and microbes help the soil to filter and buffer so that chemicals like herbicides are broken down.

Active carbon is that part of TOC which is likely to be broken down and used in the upcoming growing season. So again, more is better, as with this carbon breaking down, nitrogen is released to the crop. Higher active carbon is often associated with higher TOC. However, individual results vary greatly, and for some soils high active carbon levels are seen with lower TOC, and vice versa. There is a bit to be learned here.

Bulk density is an indicator of soil compaction and soil functions. A lower number is better, as soils with lower values allow roots to grow easier, have more pore space thus 'breathes' better, and holds more water. Bulk density will be influenced by the sand/silt/clay makeup. Sandier soils will tend towards higher values, less for silty soils, and then yet lower for clay. This runs counter to the notion that 'heavy soils' are often equated to those with more clay.

Water stable aggregates are soil particles bound together that resist breaking even when wet. A higher % is desired here, as it means the soil will be less likely to erode and crust over. They will allow water to infiltrate easier and retain more moisture. They will be easier to get across when wet and provide better seed to soil contact, which improves seed performance.

Please note that Table 1, which summarizes the soil samples submitted in 6 of the areas where there are many produce growers receiving this newsletter. There were no samples submitted from the counties of Dallas or Webster. The results for Daviess are quite good for TOC which can be typical of prairie soils.

Do any of these tests 'biological component'? Yes, active carbon gives some indication of potential biological activity. There are other tests as well, such as mineralizable nitrogen and phospholipid fatty acid analysis. For these a consensus is still being sought on the best way to interpret or present the results.

How might this work on soil health be relevant to produce growers in Missouri? Well it isn't likely you'll want to submit a sample on your own 'just to see the results'. The cost for a basic test is $30 and expanded is $80. For additional tests, some of which were performed for this study, the cost would be well over $100 per sample. One area of interest would be with a research project focused on sustainable agriculture, where samples from produce growers with some of the counties listed above are sampled. These could be compared to the samples from their own counties and the state average. With vegetable production being a somewhat differently managed cropping system, it would be interesting to see how they compare.

Table 1. Four soil health characteristics for selected counties and the entire state of Missouri.

Average results for area and sample # (XX)	% Organic Carbon	Active Carbon mg C/kg soild	Bulk Density g/cm3	% Water Stable Aggregates
Audrain Co. Mean (5)	1.5	379.3	1.21	31
Barton Co. Mean (61)	1.8	535.0	1.16	32
Davies Co. Mean (23)	2.5	684.6	1.42	41
Moniteau & Morgan Co. Mean (18)	2.0	513.6	1.30	38
Pettis, Benton, & Henry Co. Mean (22)	2.0	458.1	1.29	37
Bates & Vernon Co. Mean (38)	1.7	458.7	1.28	31
MO State Mean (1732)	1.8	485.8	1.22	36

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Wet summer leads to diseases and more interest in high tunnels

by Patricia Hosack (Director of Plant Diagnostic Clinic) and James Quinn

Missouri's erratic weather always presents challenges, and 2016 was no exception. Some very chilly weather in May lead to some warm season vegetables being held back, and as the very hot and dry June weather settled in, some struggled to adjust well, notably peppers seemed stunted. And then just as drought concerns mounted, rain came in from July through September, of course varying around the state. But one could say, everyone seemed to get their fill by the time summer closed out on the equinox.

Heavy rains in July and August, high relative humidity between rains, and warm night temperatures were conducive for disease development. Then a very rainy September made harvesting challenging as well. Besides what is listed, numerous reports of severe foliar diseases were reported by home gardeners and commercial growers. A common scenario, this season, was the inability to get a preventative pesticide out between rains.

The rain kept soils saturated and promoted soil-borne diseases, especially those caused by Phytophthora and Pythium. These two fungal-like plant pathogens are called water molds and make a motile spore (zoospore) that easily moves from infected to healthy tissues. In some cases Phytophthora diseases could be associated with low areas or standing water (flooding). One squash sample came from a raised bed system and the only diseased areas were stems that were touching the ground on either side of the bed.

Below is a list of vegetable diseases diagnosed from the MU Plant Diagnostic Clinic:

County	Crop	Disease	Date
Saint Francois	Yellow Squash	Phytophthora root and crown rot	7/20/16
Boone	Tomato	Early Blight	7/20/16
Greene	Pepper	Anthracnose	8/1/16
Greene	Pepper	Gray Mold	8/1/16
Morgan	Potato	Phytophthora root and stem rot	8/3/16
Moniteau	Pumpkin	Alternaria Leaf Blight	8/5/16
Franklin	Pumpkin	Phytophthora root and crown rot	8/9/16
Butler	Tomato	Anthracnose	8/18/16
Vernon	Pepper	Pythium root rot	9/21/16
Vernon	Pepper	Fusarium root and stalk rot	9/21/16
St. Charles	Garlic	Charcoal Rot	9/30/16

The disease pressure this year has come on the heels of relatively rainy years every year since the drought of 2012, with 2015 being quite difficult statewide. Tomatoes were very short at farmers' markets by September. This is leading some growers to consider further expanding the use of high tunnels or greenhouses.

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