THE UNIVERSITY OF RHODE ISLAND COOPERATIVE EXTENSION

VEGETABLE PRODUCTION

THE WEEK IN VEGETABLES

June 1, 2019

PEST ALERTS: NO Thrips seen yet on onions; asparagus beetles are out, though none seen yet at URI; Basil plants are waiting for warmth and sunshine (so is everything); beet/spinach leafminers are most likely near the end of egg laying for over-wintered adults- expect a new wave of egg-laying adults in about a month; Brassica flea beetles are very busy everywhere; note that garden springtails are also abundant but they do very little damage and feed on many kinds of leaves, including tomatoes, cucumbers, spinach and more- they are a little smaller than flea beetles and are not shiny and don't jump as far- some speculate they spread damping off organisms; Rhizoctonia damping off was seen on high tunnel cucumbers- this won't be seen much outside since it hasn't been warm; the warm weather should finally bring striped cucumber beetles out so make sure covers are in place; Colorado potato beetle adults and eggs were seen this week on eggplant, a few on tomatoes as well; beware of potato aphid hot spots in your high tunnel tomatoes- population growth can be explosive right now; European corn borer moths have been trapped in NY and NH, but none reported in MA; damp cool conditions have been conducive to Botrytis in young high tunnel plants- keep the air moving.
--> **Need to discuss? Got something you need looked at? URI Extension: 401-874-2967/andy_radin@uri.edu, hfaubert@uri.edu**

At West Beach Farm in Charlestown, Colorado potato beetles having a fine time on eggplant (left) while potatoes are untouched 50 feet away.

Fertigation for Fruiting Veg

Applying fertilizer through your irrigation system is an efficient and environmentally advantageous way to maintain your longer season plantings of tomatoes, peppers, and eggplants, whether you use organic methods or not.

There are a few subjects to cover here: 1) how to **apportion** fertilizer over the season; 2) **fertilizer materials** that work well through a drip system; 3) **calculating** application rates; and 4) **tools** you can use to inject fertilizer into the irrigation water.

Apportioning nutrients. Fertigation is typically used in combination with pre-plant soil-applied solid fertilizer application, both in high tunnels and in the field. That is, an initial application, perhaps 1/3 to 1/2 of the full season recommendation, is made to the soil "up front," and the remainder is divided into regular incremental applications through the irrigation system. Finer textured soils can have more nutrients applied up front (1/2 to 3/4 of full recommendation), since they are less prone to leaching and have higher organic matter content. Nitrogen in the nitrate form (much more abundant that the ammonium form), is negatively charged and thus, prone to leaching, so it is particularly useful to apportion it during the season. On well drained soils, 1/3 to 1/2 may be soil applied. Those growing on excessively drained soils can go with *only* fertigation, though this would require use of fully water-soluble nutrients to produce an economically significant yield.

The remaining nutrients in a season long recommendation are then divided among the remaining relevant weeks of the crop's time to maturity. But the meaning of "maturity" is a moving target. Well established, healthy bell pepper plants will continue to produce fruit for, if conditions are right, 6, 8, or even 10 weeks. During that time, they continue both vegetative and reproductive

Table 1: Nutrient composition of individual SYNTHETIC fertilizers commonly used in fertigation (Modified from Ext Pub 2037, Miss St. U)

Fertilizer	% Nutrient composition	pH*
Ammonium nitrate	34% N	A
Calcium nitrate	15.5% N, 19% Ca	B
Diammonium phosphate	16% N, 46% P2O5	A
Monopotassium phosphate (MKP)	52% P2O5, 34% K2O	B
Nitrate of soda potash	15% N, 14% K2O	B
Potassium chloride (muriate of	60% K2O	N
Potassium nitrate	13.75% N, 44.5% K2O	B
Sodium nitrate	16% N	B
Urea	46% N	B
"Cal-Mag"	15% N, 5% P2O5, 15% K2O, 5% Ca, 2% Mg, trace amounts B, Cu, Fe, Mn, Mo, Zn	B

*A = Acidic (will lower soil pH); B = Basic (will raise soil pH); N = Neutral (no effect on soil pH).

(fruiting) growth, both of which demand nutrients. Such a crop could benefit from additional feeding during this period. On the other hand, a vigorous determinate tomato variety such as 'Celebrity' or 'Mountain Fresh' has a harvest period of 3 or maybe 4 weeks at the most. It doesn't make sense to fertigate during the third week of harvesting these tomato varieties.

Choosing to fertigate into the later stage of crop production, such as the pepper example above, should be based on your judgement call. That can be done by "feel" in some cases: if those pepper plants are hulking and fat and green and productive in the fourth or fifth week of harvest, you may be done with worrying about fertilizer application. But if you are seeing lots of lower leaf yellowing, then it might make sense to apply. Leaf tissue testing *may* be a little more precise, though you have to base your decision on whether or not to apply on "book values" that have not been generated in our part of the world on our soils. But these "critical deficiency values" are still used regularly, and cited by labs when they test plant tissue. It's all we've got to work with, unless we initiate a study to develop precise recommendations for every crop on every soil type in every climate… which ain't gonna happen.

Use of organic or slow release synthetic nutrients up front is a really good practice but during a rainy spring, expect much of those forms to leach out, too. Organic forms of N applied as seed meals, pelletized manure, feather meal or others don't release for very long periods of time. A study done by Bruce Hoskins at UMaine shows that majority of mineralizable N has been released by 8 weeks after incorporation. This calls for fertigation for longer season fruiting crops where side-dressing isn't possible or desirable. If you have a good system down, dividing fertigation events into weekly increments makes the most sense. Bear in mind that demand is highest during that period of explosive growth in early summer and during heavy fruiting. Nutrients should be available.

Water soluble synthetic **fertilizers** (Table 1) are, of course, the easiest to work with and most efficient in terms of metering them out with accuracy. On the other hand, these are often blended when you may not want everything in a blend, or you may feel forced to apply far more P than you should in order to achieve the amount of N that you know you want. You should therefore be prepared to apply some of these as separate components. There will be Math. Or Maths, as the Brits say.

The same goes for "fertigatible" (this word will surely be trending very soon) organic fertilizers (Table 2). This chart was borrowed from an eOrganic article. Some of these products may not be available around here while others may not exist under these brand names- the fertilizer industry seems to be constantly in flux. However, the gist of this chart, other than fertilizer analyses, is how wide-ranging the cost can be, particularly when boiling it down to cost per N unit. Another issue brought out in it is that other macronutrient percentages in these fertilizers range all over the place. It completely depends on the source materials, so you have to take what you get. If you are mainly fertigating for N and the product has excessive P

Table 2. Cost analysis of organically approved fertilizer products listed on OMRI and WSDA databases on **March 1, 2010** that can be used for fertigation; products are listed in order of cost from least expensive per unit N ($/lb N) to most expensive. Always check with your certifier before using any new product. **(Source: Miles et al, eOrganic, June 11, 2015)**

Product	N-P-K	Cost	Unit	Lbs/Gal	Price/Lb	Cost/Lb N
Converted Organics 521	5-1-1	$2.25	Gal	9.8	$0.23	$4.60
Converted Organics GP	3-2-1	$1.45	Gal	9.7	$0.15	$5.00
Alaska Salmon Fish Fertilizer	4.8-3-0.5	$3.00	Gal	9.35	$0.32	$6.67
Converted Organics XK	2-2-4	$1.65	Gal	9.8	$0.17	$8.50
BWF Banducci Inc.	3-1-1	$2.50	Gal	9.6	$0.26	$8.67
BWF Banducci Inc. Secure Organics	4-1-1	$3.75	Gal	9.6	$0.39	$9.75
Phytamin Fish Plus	4.5-4-1	$5.00	Gal	10	$0.50	$11.11
BWF Banducci Inc. Organique Exquis	3.5-1-1	$3.75	Gal	9.6	$0.39	$11.14
Phytamin All Purpose	4-3-4	$4.50	Gal	10	$0.45	$11.25
Phytamin Fish Concentrate	4-3.5-0	$5.00	Gal	10	$0.50	$12.50
Drammatic Garden Fertilizer	4-4-1	$5.03	Gal	9.6	$0.52	$13.00
Phytamin Fish	3-2-0	$4.00	Gal	10	$0.40	$13.33
Converted Organics LC	1-1-1	$1.25	Gal	9.1	$0.14	$14.00
Converted Organics Pacific Choice	1-4-0	$1.25	Gal	8.8	$0.14	$14.00
Drammatic ONE Plant Food	4-4-0.5	$0.57	Gal	9.6	$0.57	$14.25
Eco-Nutrients Eco-Hydro Fish	2-4-0.2	$3.50	Gal	9	$0.39	$19.50
Drammatic "K"	2-5-0.2	$4.28	Gal	9.6	$0.45	$22.50
Drammatic "L"	2-2-0.2	$4.37	Gal	9.6	$0.46	$23.00
Aqua Power 100 % Fish Emulsion	5-1-1	$11.98	Gal	9.7	$1.24	$24.80
Bio-Gro Inc. Plant-X WSP	3-0-0	$8.00	Gal	10.32	$0.78	$26.00
Converted Organics NC	0.4-1-0	$1.65	Gal	9.1	$0.18	$45.00
ORGUNIQUE General Purpose Plant Food	3-2-5	$14.72	Gal	9.4	$1.57	$52.33
ORGUNIQUE Tomato & Vegetable Food	3-1-4	$14.72	Gal	9.4	$1.57	$52.33
ORGUNIQUE Lawn Food	3-1-5	$14.72	Gal	9.4	$1.57	$52.33
BioFert Orgunique BioFish	3-1-2	$25.93	Gal	10.02	$2.59	$86.33
Organic Gem	3-3-3	$27.95	Gal	8.5	$3.29	$109.67
Earth Juice Grow	2-1-1	$23.50	Gal	9	$2.61	$130.50
Neptune Harvest	2-4-1	$30.00	Gal	11	$2.73	$136.50

Report from Barberville

Here are goings-on from Diana Kushner of Arcadian Fields

Good (?) News: The basil is now recovering...

Not so good news: The tomatoes, which looked fine when we planted them last week, got diseased in the field, at least I think they did. We sprayed copper and then took off the bad leaves (most of them), so now we have stunted little Dr. Seussian plants in the field. Hoping warm weather will come and they will make a robust recovery. This is the first time that anything like this has happened here. Usually we see no sign of disease for at least a month after planting. (UPDATE: Plants are recovering nicely.)

Odd news: The perennials had a bad winter. The lavender died, as did most of the sage, the eastern end of three mint beds and most of one garlic chive bed. Why? Could it be that I put about one inch or less of compost on the beds in the fall? Don't think so, since I do that every other year or so. Meanwhile, the chives are thriving, as are the raspberries, blueberries, blackberries, strawberries, rhubarb, lovage... I just don't get it. These beds have been established for years. And who knew that mint could ever die?

A bit of self promotion: I'm doing a CSA on the farm, a small one. So if you know of any people who like to eat exactly the same kinds of veggies that I like to grow, and who don't mind eating mint from the western half of the bed, please pass on the news!

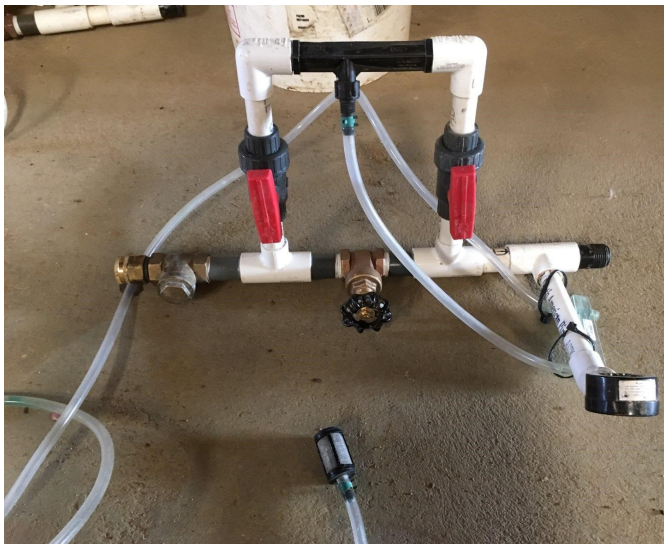
and your soil is testing through the roof for P, then you might avoid such a product.
Since organics are really suspensions, not solutions, you are running particles through your drip tubes. Flushing should be done following fertigation to prevent clogging of pores and emitters and to avoid microbial slimes.

Calculations. The long season fruiting vegetables demand large amounts of N and K so these should be your primary concern. Heavily cropped soils may need to be amended with select micronutrients, but if you have applied large amounts of manure or compost over time, these are likely not lacking unless the pH is extremely high or low. Boron is one to pay attention to since it is easily leached, but it is also used by plants in exceedingly small quantities. Do not over apply Boron. Also, it is most efficiently taken up by plants through the roots, not by foliage. If calcium is on the low side and pH is in a desirable range, you can apply gypsum, calcium sulfate, directly to the soil. It will not raise pH. This is cheaper and longer-acting than expensive liquid calcium products that seem to be pushed at everyone.

Here are sample calculations thinking from the perspective of Nitrogen application on an organic field. Let's say you are choosing to go with a season-long recommendation for field tomatoes of 140 lbs N, 30 lbs P (as P_2O_5) and 150 lbs K (as K_2O) per acre.

- Your patch size: 8,000 sq ft
- Up front application: 100 lbs N/acre
- Planting date: May 25
- First planned fertigation: 6 weeks after transplanting
- Anticipated harvest period: August 3-31
- Last useful fertigation date: July 27
- Number of fertigations: 4
- Lbs N/acre per fertigation: 10
- Lbs N/8,000 sq ft (0.1875 acre) per fertigation: 1.8

SO- what product(s) will you use? Let's say you choose Aquapower 5-1-1. **Remember** that fertilizers are analyzed by **weight.** This means you have to know the weight of the liquid you are using to figure out how much N is in it. This is *usually* (but not always) supplied on the label in the fine print. This label was on the internet: it's 9.6 lbs per gallon. Each 9.6 lb gallon is 5% N, which is 0.48 lb N (per gallon). It takes 3.75 gallons to get 1.8 lbs of N. That's a substantial amount of sludgy material to send out through your drip tapes so it should be diluted, probably by at least 3 parts water to 1 part liquid fertilizer.
If you are interested in boosting potassium and you follow organic practices, sulfate of potash is the most efficiently useable material. It will actually dissolve, but use hot water and give it some time. This material is 50% K_2O. To apply 10 lbs K_2O per acre per week on your 8,000 sq ft patch, it's simpler since it's a solid: again, it's 1.8 lbs K_2O per 8,000 sq ft; Sulfate of Potash is 50% K_2O; 1.8 lbs/0.50 = 3.6 lbs sulfate of potash applied to 8,000 sq ft.


Fertilizer injector assembly

Fertilizer **injectors** can be super cheap or pretty costly, but what you use may have more to do with the fertilizer materials that you use. The Cadillacs of injectors are mechanical pumps operated by running water. These are very precise and are really designed for greenhouse container growing where they use "constant feed" of synthetic, 100% water-soluble fertilizers. They need to be kept clean internally, and for that reason, you may not want to use organics in them. Also, fertigation in the field is not a constant feed operation. The point is to get X lbs of material out onto Y thousand square feet of growing area. So there's no need for the kind of precision that these pumps are capable of.

There are very cheap proportioners that are in-line fittings that draw up very small amounts of mixed material. Unless you have a very small area to fertilize, like your greenhouse seedlings, avoid this for field use.
Venturi type injectors operate very simply and are relatively inexpensive. They come in different diameters of plumbing based on your pressure and flow rates and quantities you are expecting to deliver. If you grow on less than 4 or 5 acres and have good pressure and flow, you would be fine with 1/2 or 3/4 inch units. You can do the plumbing yourself or purchase pre-assembled units with a bypass and nice switches.

There's plenty more to discuss. If you are getting rigged up and want your math checked, please contact Andy.

Report from Middletown

Goings on from Garman Farm

Well, we had a few snatches of decent weather. Our current GDD (Base 50 F) are at 192.5, with the five-day soil temperature averaging a solid 59 F. Tomatoes that went out into the field are not particularly happy but they are holding their own in these dreary conditions. Cukes and zucchini germinated on black plastic and under row cover, but those sweet potatoes will have to wait a bit.

Flea beetle pressure has been relatively light, so far, and few cabbage moths have been seen. We did have some potato aphids on eggplant seedlings in the greenhouse, but two sprays of Azera at three-day intervals seem to have taken care of that. We also noticed some leaf miner eggs on chard transplants. They ate Spinosad and died.

We use a lot of row cover – it seems like two-thirds of our farm is under cover – and are weary of scrounging old lumber and rocks to hold them down. We recently switched to anchor bags (don't call them *sand bags* when you call Progressive!) This is labor intensive but cost effective – two yards of sand are $40 delivered, and the woven anchor bags are 33 cents each. Thus you can fill 180 sandbags – enough to cover about 1,300 row feet – for about $100. They seem to provide a more even seal than random warped 2 x 4s, and are also aesthetically pleasing. Filling them in February would be wiser than two hours before planting zucchini. We are always learning something around here. Hope everyone's doing well, and that your market stalls are filled.