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Infestation hits first-year multi-variant tomato trial

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Posted by [aaron](#)

By *Miriam Gieske*

The results from this year's Rodale Institute tomato trial don't look pretty. Like many farmers this year along the entire East Coast, particularly the Northeast, we struggled with weather too wet and cold for a subtropical fruit and, subsequently, disease that thrived in those tomato-negative conditions.

Nonetheless, we got some tasty tomatoes—and some information to share about using rolled cover crops for vegetable production.

Research set-up

In the fall of 2008, we planted plots of three cover crops: hairy vetch alone, rye alone, and a mixture of vetch and rye. We allowed them to over-winter and grow in the spring, then rolled them with our [roller-crimper](#) when they reached the flowering stage. The resulting mat became mulch for our 1,440 tomato plants as we examined the effects of the respective cover crops as well as mycorrhizal (beneficial soil fungi) inoculation on yields, weed pressure, and cost of providing nitrogen for the plants relative to yield obtained.

We planted three varieties of tomatoes: two hybrids, [Juliet](#) and [Pink Beauty](#), and one large-fruited heirloom, [Striped German](#). We spaced the plants 18 inches apart within the rows, with 40 inches between rows, for a total of 120 plants per 20- x 30-foot plot or about 8,700 plants per acre. Half the plants in the test plots were inoculated with mycorrhizal fungi, which have been found to increase plants' phosphorus, zinc, and copper uptake and improve soil structure.

Small crop-free areas within the plots allowed us to separate the mulch's contribution to weed suppression from that of the tomatoes. Over the summer, we measured weed biomass and tomato yields. This year's late blight epidemic also allowed us to gather some information on disease resistance. Now that the growing season is over, our tomato patch has been plowed and is planted to rye, ready to wait for another year.

2009 research results

Big differences in cover crop mulches

Rye at both seeding rates (3 bu/acre and 1.5 bu/acre) grew very well, producing similar amounts of mulch – about 10,000 lbs/ acre and 7,500 lbs/acre, respectively. The vetch performed poorly, both when planted alone at 30 lbs/acre and when planted with rye at 15 lbs/acre. Alone it produced only about 3,000 lbs/acre of mulch, and with rye it produced negligible biomass. However, despite relatively poor performance (probably due to a too late planting date), the vetch still provided 100 lbs of nitrogen per acre, more than meeting tomatoes' 50 lbs/acre requirement. This year we're expecting even better mulch production by all cover crops, since they were established in August instead of October.

No difference in yield between plants inoculated with mycorrhizal fungi and those not inoculated. This is really not too surprising. From a plant's point of view, the main reason for associating and cooperating with these fungi is that they help the plant explore all the nooks and crannies of the soil in search of phosphorus. In return for that help, the plant gives the fungus food in the form of sugars. But tomatoes have a lot of fuzzy

little feeder roots, so they're really good at exploring those nooks and crannies themselves. Besides that, our soil is very high in phosphorus as a result of centuries of being amended with manure—especially this field, which is just behind the barn! Our tomatoes simply didn't need the help of the fungi.

Cover crop treatment affected weed pressure, but did not affect yields. Four weeks after we rolled our cover crops and planted our tomatoes, the amount of weed biomass was about the same no matter what cover crop was used. By 10 weeks after rolling, however, the vetch plots had become significantly weedier than the rye or rye-vetch mix plots. In spite of that, the vetch plots yielded just as much as the others, perhaps because the rolled-down vetch gave the tomatoes an early nitrogen boost and a head start on the weeds.

Vetch a much more economical nitrogen source than fish emulsion. We side-dressed the rye and vetch-rye mix plots with liquid kelp/fish emulsion at a rate of 20 pounds nitrogen per acre in the rye plots and 10 pounds nitrogen per acre in the vetch-rye mix plots. We did not side-dress the vetch plots. The fertility cost (cover crop seeds and/or side-dress fertilizer) worked out to:

- \$58.80/acre or 0.9 cents per pound of tomatoes for the vetch
- \$445.83/acre or 8.1 cents/lb tomatoes for the vetch-rye mix
- \$825.95/acre or 13.8 cents/lb tomatoes for the rye.

Of course, using manure or compost as a supplemental nitrogen source instead of fish emulsion would bring the cost of fertilizing the rye and vetch-rye mix plots down considerably. We needed to avoid using manure because of our high soil phosphorus levels, but where this imbalance is not a consideration, manure or compost could be a good option.

Tomato plants suppress weed growth. There was about half as much weed biomass in the alleys between the tomato rows as in the "crop-free zones" where we didn't plant anything into the mulch, which means the tomatoes themselves helped keep the weeds in check. Go tomatoes!



This Pink Beauty plant shows the advanced lesions and black, desiccated leaves typical of the 2009 late blight.

Late blight survival varied by variety. The pathogen appeared on our plants in early August. We considered spraying with copper (a synthetic fungicide that is **allowed but restricted** within the National Organic Program), but decided against it because copper is expensive, doesn't work very well, and can poison the soil if it's used too much. We pulled out two of our varieties, Juliet and Pink Beauty, in hopes of slowing the spread of the disease. We were pleasantly surprised to discover that our sole heirloom variety, Striped German, was partially resistant to the blight. While some of the fruits developed the tell-tale late-blight lesions, the leaves were unscathed by the usual browning and withering of the disease. We left Striped German plants in the ground and they kept trooping along through early September, putting out big and tasty—if at times rather ugly—tomatoes.

Tomato yield was much lower than Pennsylvania's commercial field average for the last 10 years—around 6,000 pounds per acre versus a range of 10,500 to 22,000 pounds per acre. This was largely due to the weather and the blight, although it must be admitted that our management played a role as well. We started our tomatoes too early and didn't feed them enough before transplanting, so when we put them out in the field

they were pretty leggy and pitiful-looking. The ones transplanted into the vetch mulch greened up quickly, but the ones transplanted into the other mulches took several weeks to catch up.

Building on what we've learned from this year, we plan to do a similar tomato trial in another field in 2010. We will have the same three cover crops (rye alone, vetch alone, and vetch plus rye) and test three different ways of terminating them: plowing, rolling, and undercutting. We will also have plots mulched with black plastic for comparison. Many organic farmers use plastic mulch to suppress weeds and warm the soil, but the use of plastic mulch has negative environmental consequences since it increases runoff from the fields, reduces soil organic matter by speeding up decomposition and often cannot be recycled after it is used.

We hope to show that rolled cover crop mulches are a feasible alternative to plastic mulch for organic growers. We also plan to do a trial of rolled rye mulch for green bean production.

We'll keep you posted about these trials on our website, so stay tuned!

Miriam Gieske was a 2009 research intern at the Rodale Institute.

Rodale Institute photos by Miriam Gieske and Greg Bowman

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10 Responses to "Infestation hits first-year multi-variant tomato trial"

1.  *LindaB*
January 23, 2010

Just read your article and am very excited on your methods. I have a couple of questions.

1) define rolled, what does that look like?

I live in West Michigan where the soil is mostly acidic sand. Last year I used moldy hay that I bought from a local farmer for mulch, for moisture retention, weed suppression and to add organic matter to the soil. (seriously our soil looks like dirty sand box sand, no organic material) I was happy with the results but am concerned.

2) Would the mold on the hay spread disease to the plants?

3) Could I use this method year after year? The seeds from the grass hay (mostly Timothy) could be allowed to grow in the fall after tilling the garden under.

What do you all think??

Reply

-  *Rob Malcomnson*
February 1, 2010

I live in east Michigan but am familiar with your soil type.

Moldy hay will not spread fungal diseases, as the species are different.

Any hay seeds that sprout in the fall will do little good, but will not hurt either, as they can be easily killed in the spring. If you want a green cover that winter kills, use oats. For a vigorous overwintering cover, use rye. It can be planted up until the second week in November and still come up.

You can use old hay every year, and probably should. Use first cutting hay for crops needing less nitrogen and second/third cutting alfalfa for additional nutrients.

Reply

2.  *Anonymous*
May 8, 2010

With the blighted tomatoes last year, do we have to treat the soil this year in which the blighted tomatoes were grown? Thank you.

Reply

3.  *Anonymous*
January 21, 2010

Great job! Keep the results coming! It is much appreciated!

Cindy

Reply

4.  *Anonymous*
January 22, 2010

All of your articles cause my thought processes to start churning. We generally cover crop in the summer in Florida, so rye is not a possibility. We do have a native variety of vetch which is supposedly a great nitrogen fixer. Hmmm... what would happen if?

Reply

5.  *Kevin Johnson*
January 22, 2010

Guys,

You could save labor time, money and have healthier sustainable crops by using the Pathway Bacteria Technology. <http://www.pathway-technologies.com>. They have multiple approaches to growing crops. They do use some Mycorrhizal Fungi, but mostly Rhizobial Bacteria.

They have a multitude of strains that block fungus from attaching the roots, break apart changes of phosphorous and calcium, produce anti-bodies, and so on. Over one hundred Golf Courses are now using this system to block Brown Patch and Dollar Spot. Some of the largest Vegetable Growers in CA and FL are now using this system to grow their crops. The bacteria is placed weekly into the soil and only costs 2.50 per acre per application. Pathway also has a liquid fertilizer that contains 39 strains of soil bacteria, amino acids, humic acid, and sea kelp. It is also very inexpensive.

Check out the web sight. They have tested the products on Tomato's with great success. I believe they also have a method of blocking Tomato Blight.

Kevin

Reply

-  *ANDRE KINDUELO*
September 20, 2010

Dear Kevin,

I am interested by the products you spoke about in your submission, but it seems the Pathway technologies website address you mentioned is not correct..

May you check and revert please ?

Thanks and regards

Andr

[Reply](#)

6.  *Linda Halley*
January 31, 2010

A major motivation to use plastic mulch in our area is to heat soil and urge earlier tomato fruiting and ripening. In my experience, mulch, whether grown or applied, cools the soil and slows ripening and growth down. An trial to compare total yield (which should be higher if ripening begins earlier) and earliness would be valuable to us in the northern tier of states.)Earliness can also be a major factor in sales and price so it is no small deal.)

[Reply](#)

7.  *Anonymous*
January 24, 2010

We need a way to try the rolling of winter cover crops on small scale market farming. Someone suggested a 4-foot wide "rollar" you fill with water to roll down asphalt when you redo your driveway. Have you ever tried this? Will it work? We can't afford to buy tractors. Where would you buy a rollar like this?

[Reply](#)

8.  *Lily*
January 22, 2010

I always wonder of the information provided is applicable to my area, San Antonio TX. Are there any RODale materials SPECIFIC to my area- we sit right on a microclimate; arctic breezes in winter -or summer under certain conditions, coastal storm attacks, 90% avg. humidity. We are a lot like Florida, but not exactly. Florida has sand, and we have caliche. I have been composting my own soil additives for ten years, and for 2 people on just under an acre, it's slow !

So, anything just for us in San anto?

[Reply](#)

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