Mind the Gap: Cover Crops and Black plastic mulch

Molly Shaw, CCE with Ross Shoultes, grower in Owego, NY

Black plastic mulch (either regular plastic or the biodegradable version) has become a staple on NY veggie farms. We love how it provides a weed barrier around plants and heats up the soil. But what about that aisle area, that gap of bare soil between rows of mulch?

There are three basic options: keep the soil bare all summer, mulch with straw or hay, or allow something to grow on it. Bare soil can be maintained with cultivation or herbicides. A few farms use the hay/straw mulch, though on a large scale this can be pricy and a haven for voles. The default option is weed cover, and we see that on plenty of farms, often interfering with harvesting ease. But what if you could opt for a low-cost, low-maintenance green cover that actually improves the soil?

That's the cover crop technique that one vegetable farm in Owego (Southern Tier NY) has trialed for the last couple years. This particular farm is blessed with an amazingly forgiving soil type, silty loam without stones in a creek valley that rarely floods. For the last couple decades the fields have been intensively used for vegetable crops, many on black plastic. The aisles have been maintained as bare ground with a rototiller, usually rototilling 4 time**s** per season, or until selling at farmers markets becomes all-consuming and the weed control slips, producing some of the most verdant pigweed I've ever seen.

Because of the intensive tillage, the soil health test from this farm showed very low organic matter (2.2%, compared to 3.8% in the hedgerow), leading to extremely low aggregate stability and active carbon. See sidebar for test results. Low aggregate stability means that when it rains, the

	Indicators	Value	Rating	Constraint
PHYSICAL	Aggregate Stability (%)	20.6	22	aeration, infiltration, rooting
	Available Water Capacity (m/m)	0.24	93	
	Surface Hardness (psi)	145	63	
	Subsurface Hardness (psi)	294	49	
BIOLOGICAL	Organic Matter (%)	2.2	16	energy storage, C sequestration, water retention
	Active Carbon (ppm) [Permanganate Oxidizable]	303	5	Soil Biological Activity
	Potentially Mineralizable Nitrogen (μgN/ gdwsoil/week)	10.0	42	
	Root Health Rating (1-9)	3.5	75	
CHEMICAL	pH (see Nutrient Analysis Report)	5.9	56	
	Extractable Phosphorus (see Nutrient Analysis Report)	14.5	100	
	Extractable Potassium (see Nutrient Analysis Report)	127.5	100	
	Minor Elements (see Nutrient Analysis Report)		100	
OVERALL QUALITY SCORE (OUT OF 100):			60.1	Medium
Soil Textural Class:==> silt loam				
SAND (%): 18.0		*SILT (%): 72.0*		*CLAY (%): 10.0*

Soil Health test results for this intensively- tilled mixed vegetable field from 2007. Notice the low aggregate stability, low organic matter, and low active carbon. Interestingly enough, the chemical soil properties look pretty good. That means that a normal nutrient test wouldn't have shown any concerns besides the low organic matter. Aggregate stability in our September between-plastic tests (even under ryegrass) is quite a bit lower than it was in May 2007, when the original soil health test was taken. This may be a partly a seasonal effect (fall test versus spring test), or reflect continued soil

impact of the droplets breaks the crumbles in the soil and the soil surface "melts," then dries into a crust. This makes seed emergence and future water penetration difficult, as well as increases erosion. Low active carbon means that there isn't a lot of easily-digestible carbon forms (like sugars, starches) in the soil, so the microbial population is starving and less populous. This decreases nutrient cycling and further decreases soil structure because the microbes aren't making the glues to hold soil particles together. Sure enough, this farm sees crusting on their soil. They also had a hard-pan at the rototiller depth, which on a wet year lead to water ponding in the field after a rain.

Cover crops with fibrous root systems (like sods) that can be left in place for long periods of time tend to be the best at increasing aggregate stability and active carbon, but this farm is land-limited and wants to crop (or double-crop) every piece of ground every year.

We decided to try cover cropping half the field at once—the aisleways—which would at the same time reduce tillage, and we also hope for lower maintenance than with rototilling.

We chose annual ryegrass and planted it in April, as early as we could (right after the plastic was laid). Annual ryegrass fills in quicker than clovers, so usually competes better with weeds right off the bat. The ryegrass took 2 mowings during the season, as compared with 4 rototillings for the bare soil.

In September, we tested the soil again to see if active carbon and aggregate stability had improved under the ryegrass, compared to the area that was still rototilled. We would really like overall organic matter to improve, but that is a long, slow process. Since aggregate stability and active carbon change much quicker than overall organic matter, we looked for encouragement there.

Sure enough, they had both improved under ryegrass. Rototilled aisles averaged 6.9% aggregate stability, while cover cropped ones averaged 8.7%. That is a small move when you consider that the hedgerow sample on this soil (considered the best condition this soil can be in, with no tillage or traffic) had an aggregate stability of 41%. But still a move in the right direction. Active carbon made a move in the right direction too, from 234 ppm in the rototilled aisles to 290 ppm in the cover cropped aisles. Both still in the "red zone" on the soil health test, and lower than in 2007, but the cover cropped aisle was significantly better.

Pitfalls to cover cropping the aisle:

We've made the mistake of waiting too long to plant the ryegrass, and when planted in late May it has a much harder time holding its own against annual weeds like ragweed and pigweed. One key to making this work is planting the ryegrass early, when the soil is are cooler and there tends to be more moisture. This timing means laying plastic early. Another farm that uses annual ryegrass extensively lays all their plastic (even biodegradable) early so they can get the ryegrass established, even if they don't plant warm season crops until a month or more later.

It's best to spread the ryegrass before the crops are planted on black plastic. It's hard to keep the grass seed out of the planting holes otherwise. Weeding ryegrass out of the planting holes involves a lot of preventable misery. Spreading seed before the plastic is planted also has the advantage that any seed

that falls onto the plastic blows onto the bed shoulder, hopefully making the ryegrass thicker in this trick-to-mow area.

We raked the ryegrass seed into the soil after planting, but if it is planted early with good soil moisture this step isn't necessary. Often the ryegrass seed comes up best where foot and tractor traffic has squished the seed into the soil as the black plastic mulch is being planted.

Sometimes with raised beds the bed shaper leaves a bumpy aisle between the beds, with really steep sides. It's best to smooth this out with a cultivator before planting the ryegrass, otherwise mowing is an arduous task. Using a hand-held weed whacker for acres of black plastic isn't fun. Some farms opt for the weed whackers that are on a set of wheels.

Rather than aim for a specific rate when spreading the seed, we just try to leave 1-3 seeds per square inch. When ordering seed, I'd get 50-60 lbs/acre of between-plastic space, at least. This is 2-4 times the recommended (15-30 lb/A) seeding rate.

Spring is a hectic time of year, but remember that spreading ryegrass seed with one of those over-the-shoulder spinner spreaders is really quick, basically as fast as you can walk the row-middles. If you delay, it often just doesn't get done. So order your seed now and mind that gap between black plastic beds this spring.

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