

Building a Regenerative Agricultural
System using No-Till Permanent
Raised Beds



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What is Regenerative Agriculture Anyway?

“Regenerative Agriculture describes farming and grazing practices that, among other benefits, reverse climate change by rebuilding soil organic matter and restoring degraded soil biodiversity – resulting in both carbon drawdown and improving the water cycle.”

Source: Regeneration International

<https://regenerationinternational.org/why-regenerative-agriculture/>



Regenerative Management Strategies

- Planting perennial crops
- Keeping soil covered
- No-till and low till
- Composting
- Ecological Silvopasture
- Ecological Aquaculture
- Efficient water use (e.g., drip irrigation)
- Efficient organic fertilizer use





2013



2013





2014



NESARE Research Objectives

Explore if/how our no-till permanent raised bed system works to

- Reduce weed pressure
- Improve soil health
- Increase production potential (crop yield)



Weed Management

- Herbicides
 - Herbicide resistance
- Tilling
 - Compromise soil health and disturb weed seed bank, requires equipment
- Plasticulture
 - Costly, requires special equipment, and creates disposable waste products

*Create annual expenses and require hours of on farm labor

*Crops outcompeted by weeds = lost income for the farmer



Soil Health

- Increase soil organic matter (SOM) formation
 - Can be used on “marginal” lands
- Increasing soil water holding capacity
- Improving soil carbon storage
- Reducing leaching and runoff



Production Potential (Yield)

- Not spatially constrained to fit farm equipment
 - Can plant more intensively
- Lower barrier to entry
 - Decreased long-term capital inputs











No-till Permanent Raised Beds



Bed
(Row)

Walkway
(Inter-row)

Other Passive Weed Management Strategies





University of New Hampshire researchers have found that using black tarps and cover crops successfully suppressed weeds in an organic vegetable system

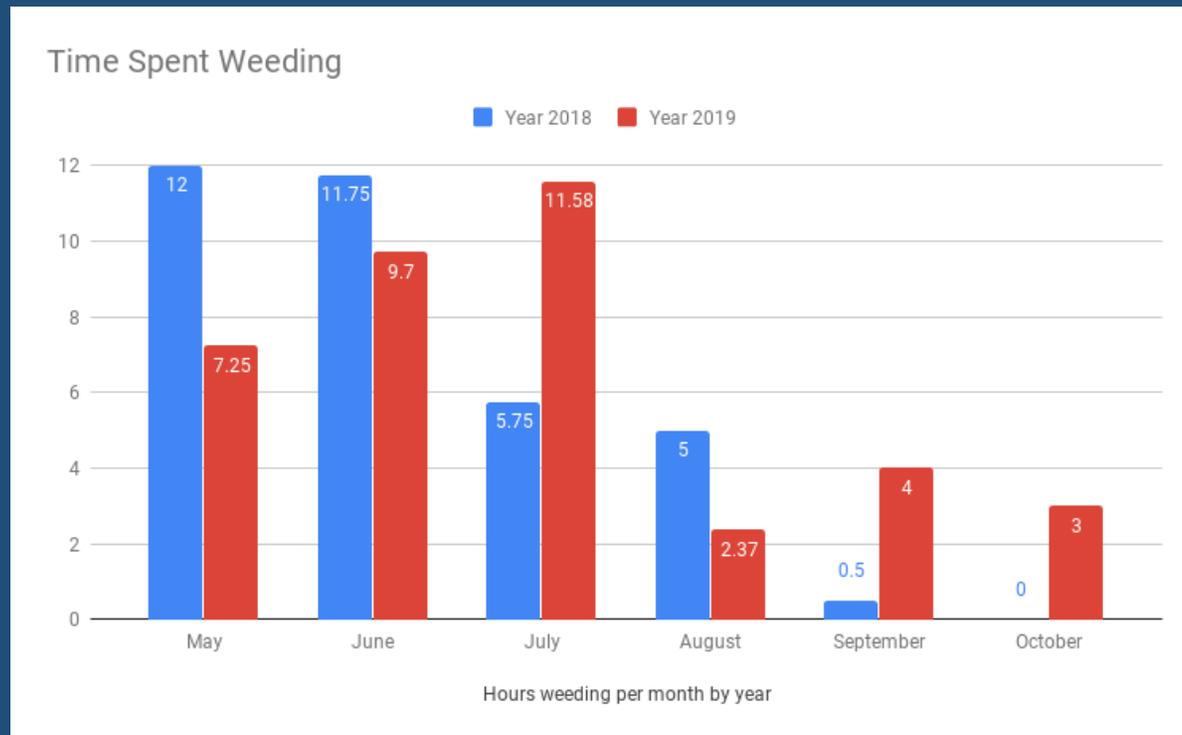




Sillage Tarps

The UV-treated polyethylene tarp we use for clearing our permanent beds of crop residues while keeping weeds in check are silage tarps. — Jean-Martin Fortier The Market Gardener

Research Results: Weed Management



Results indicate that our farm has high weed diversity, but low abundance. Annual weed pressure varies (2018 mast year for maples).



Research Results: Soil Health

Comprehensive Assessment of Soil Health

From the Cornell Soil Health Laboratory, Department of Soil and Crop Sciences, School of Integrative Plant Science, Cornell University, Ithaca, NY 14853. <http://soilhealth.cals.cornell.edu>



Group	Indicator	Value	Rating	Constraints
physical	Surface Hardness			Not rated: No Field Penetrometer Readings Submitted
physical	Subsurface Hardness			Not rated: No Field Penetrometer Readings Submitted
physical	Aggregate Stability	64.7	85	
biological	Organic Matter	3.0	88	
biological	Soil Respiration	0.9	87	
biological	Active Carbon	443	48	
chemical	Soil pH	5.6	19	Low pH: Toxicity, Nutrient Availability (note exception for acid loving crop species)
chemical	Extractable Phosphorus	9.0	100	
chemical	Extractable Potassium	54.9	80	
chemical	Minor Elements Mg: 37.8 / Fe: 6.6 / Mn: 3.7 / Zn: 24.3		100	

Overall Quality Score: **76** / Excellent

Group	Indicator	Value	Rating	Constraints
physical	Surface Hardness			Not rated: No Field Penetrometer Readings Submitted
physical	Subsurface Hardness			Not rated: No Field Penetrometer Readings Submitted
physical	Aggregate Stability	73.2	92	
biological	Organic Matter	7.9	100	
biological	Soil Respiration	0.9	87	
biological	Active Carbon	1116	99	
chemical	Soil pH	6.5	100	
chemical	Extractable Phosphorus	19.8	100	
chemical	Extractable Potassium	118.9	100	
chemical	Minor Elements Mg: 315.7 / Fe: 6.1 / Mn: 4.5 / Zn: 5.4		100	

Overall Quality Score: **97** / Optimal

Control samples (from surrounding sod) were better than expected, but low Active Carbon and low pH compared to soil from within PRB system.



Research Results: Production Potential



No significant difference between treatments ($p=0.941$), which indicates yields are steady over time (one year after system is established)



Managing a No-till Permanent Raised Bed System

- Without structure, soil can shift
 - You may need to rake up the sides of you beds every year to reshape
- You may need to add more hardwood chips to walkways every few years
- You may need to add more compost (as amendment) every few years
 - I suggest getting your soil tested to make informed decisions
- Snip crops with deep root structure to reduce chance of pulling up weed seeds from below (e.g., tomatoes, eggplant, peppers, sunflowers, etc.)



No-till Permanent Raised Bed System: Challenges

- Upfront costs
 - Purchasing hardwood chips and compost
- Compost can have trash in it
- Potential for compaction
- Takes one year to establish productive growing spaces
- Prime habitat for moles (can be bad) and voles (can be good)
 - Both aerate the soil



No-till Permanent Raised Bed System: Benefits

- Reduced weed pressure compared to traditional organic agriculture
 - Eliminates need for plasticulture (plastic mulch)
 - Drastically reduces labor costs for weeding
 - Eliminates costly mechanical equipment
- Rapidly builds soil organic matter
- Builds healthy soil structure/ecosystem
- Sequesters carbon



Alternative PRB system for prime soil

Year 1

- Till area
- Smother with silage tarp
- Form beds with tiller
- Cover beds with 2-4 inches of weed seed-free compost
- Seed beds with cover crop for one year
- Cover walkways with hardwood chips

Year 2

- Prep beds and plant cash crops



Fat Peach Farm

2014



2017



2013



2017



Ecosystem Restoration = Regenerative Agriculture







2018



2019





























FAT PEACH FARM

Questions?

