A Vermont Case for Conservation Agriculture:
Foster Brothers Farm Inc. | Middlebury, Vermont

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INTRODUCTION

George Foster and his son, Jeremy, manage crop production on the Foster family's fifth generation 2,200-acre dairy farm in Addison County, Vermont. On the very heavy clay soil (Vergennes clay) that makes up the predominant soil type on their farm (along with some lighter soil too), they grow 550 acres of corn silage, 300 acres of soybeans, 100 acres of small grains and the balance in grass/legume hay and haylage each year. The family not only sells milk through the Agri-Mark Family Dairy Farms® cooperative where it is made into world famous cheese, but they also operate Vermont Natural Ag Products—home of the Moo™ line of compost and soil amendment products.

Today George has become a humble, but impactful leader of a soil health movement in Vermont. While the farm has always had a conservation ethic, George and Jeremy have dramatically changed their cropping systems over the last eight years. After some failed attempts at no-till 20 years ago, George attended the UVM Extension No-Till & Cover Crop Symposium and knew he could make it work on their farm. He had a solid vision, and took a pragmatic approach to putting it to work on the farm.

« FOSTER BROS. FARM INC. »

LOCATION
Middlebury, Vermont

WATERSHED:
Otter Creek/Lake Champlain

ACREAGE/CROPS:
550 acres of corn silage
300 acres of soybeans
100 acres of small grains
1,250 acres of hay & haylage

CONSERVATION PRACTICES:
Cover Crops
Residue Management (No-Till)
Crop Rotation
Dragline liquid manure applications
Nutrient Management

MAKING THE TRANSITION

After acquiring a new no-till corn planter in 2012, the Fosters started their transition to no-till in their corn silage crop, beginning with their lighter soils that were in continuous corn and on their clay fields being rotated to first year corn from sod. They paid careful attention to nitrogen management, splitting sidedress applications and adjusting their starter fertilizer approach. This strategy proved successful, as they did not see the typical yield reductions that no-till can be famous for, In fact, their yields have increased since they made the switch. George attributes a lot of their success to cover cropping, which they started simultaneously. Since that first investment in equipment, they have added a no-till drill, and a roller-crimper to the mix, while also making adjustments to their corn planter. They now no-till plant all their crops (annual and perennial) and cover crop in the corn and soybeans. They also grow their own cover crop seed. This not only saved money on seed costs, but opened a window for August perennial seedings, which has proven successful too—yielding 3 cuts in the first harvest year.

Why cover crops??

When you ask George why he grows cover crops, he'll tell you, **"It's what makes no-till work!"** He's sure it's the reason no-till didn't work 20 years ago when they first tried it. He explains that the cover crop roots open up the soil while the leaves protect the soil surface. The combination of no-till and cover crops has created a resilient and healthy soil that infiltrates and stores water better, while simultaneously draining better. The result is less drought stress and (clay) fields that can withstand a 2-3 inch rain storm and be ready to plant in a day or two. Other benefits George attributes to his cover cropped, no-till system include: increased soil organic matter, higher earthworm populations, elimination of soil crusting and increased soil structure that results in equipment staying up, reduced compaction that requires far less downforce on the corn planter, and steady and resilient crop yields in both wet and dry years. All of which are hard to quantify in dollars and cents, but George knows he's getting a return on his investment.

Cost of Entry

Cost of entry is a common challenge and concern for producers. New no-till planting and cover crop management equipment can be costly. Many producers space out these investments over time, often as they increase their adoption of these practices. When producers are first starting out, borrowing equipment or hiring custom work is often a desired way to test out which equipment and systems work the best. In many cases, cost share and grant funding can be acquired to defray costs.

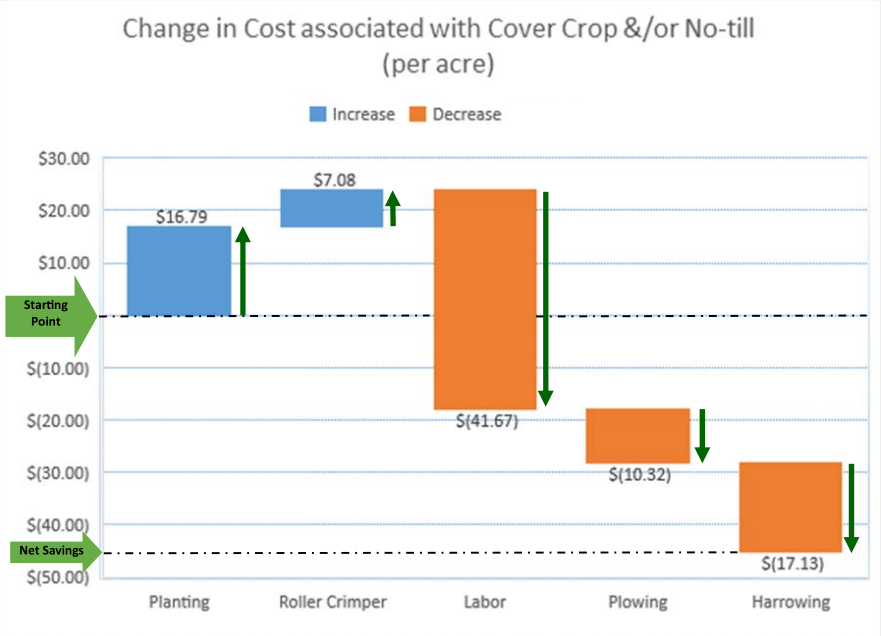
At **Foster Brothers Farm**, George and Jeremy did all of the above. Their initial investment in a no-till corn planter, was then increased as they added technology to make the planter better suit their needs. They also took advantage of grant programs. Out of pocket expenses made up roughly 53% of the actual equipment cost. When divided by the savings seen annually just on their 600 corn acres (see next page), this investment was paid for after 5 years. If you add in soybeans and small grains, it only took 3 years to see a return on that investment.

Cost of Entry

New Equipment	Purchase Price	Incentive payment	Out of pocket
3600 Kinze planter	$ 92,000.00	$ 40,000.00	$ 52,000.00
5660 Landoll Drill	$ 95,000.00	$ 80,000.00	$ 15,000.00
30' Roller Crimper	$ 25,000.00		$ 25,000.00
Equipment Modifications	$ 42,300.00		$ 42,300.00
Total	**$ 254,300**	**$ 120,000**	**$ 134,300**

CHANGES IN COST ASSOICATED WITH COVER CROPS & NO-TILL

The waterfall graph to the right shows the annual cost categories that were impacted by the addition of cover crops and adoption of no till practices. The machinery cost for each task was determined by using the NRCS Machinery Cost estimator (Cover Crop Economics Tool, version 3.1), This cost includes fuel, repairs, depreciation, and many other expenses associated with owning and using equipment. Labor cost was based on actual numbers as reported by the farm. This farm saw an increase in cost related to planting the cover crop, and on use of a roller crimper for termination of cover crop. Cost decreases were seen in labor, plowing, and harrowing. It is to be noted that these are economic cost estimates for this farm and are not cash expenses for any given year. The net effect of these changes is a ~**$45 decrease in cost as compared to conventional tillage this farm.**



Changes in Cost attributed to CoverCrop &/or No-till

Increase in Cost (per acre)		Decrease in Cost (per acre)			
					total/acre
Cover Crop Seed[1]	-	Labor			$ 41.67
Machinery Cost of Planting[2]	$ 16.79		Per pass	# of passes	
Termination		Machinery Cost[2]			
Spray[3]	-	Plowing	10.32	1	$ 10.32
Roller Crimper	$ 7.08	Harrowing	5.71	3	$ 17.13
Total	**$ 23.87**	**Total**			**$ 69.12**

[1] Seed is raised on 80 acres
[2] Source NRCS Farm Machinery Cost Estimator *Cover Crop Economics Version 2.1*
3 No change due to Cover crop/No till practices

COVER CROPS + NO-TILL = NET GAIN FOR FOSTER BROTHERS FARM

Less labor

More efficient field operations meant the spring field crew went from 5 to 2 people.

Better crop quality

Corn getting planted quickly and the ability to get on fields even after rain for planting and harvesting means better corn silage quality. It also means first cut can happen on time during that May time crunch, also equating to better haylage quality.

No more replants!

Better soil quality and resiliency has meant no more replanting corn.

Increased Yields

The farm has seen steadily increasing corn yields, partially by paying special attention to nitrogen as they transitioned

Soybean yields increased from 40-60 bushels per acre to 70-90 bushels per acre.

With increased flexibility and better equipment, new hay seedings can now happen in August following a harvest of winter rye seed (instead of May), and the farm now gets 3 cuts of hay in the first year.

What weather?

With increasing uncertainty in weather patterns, the Fosters have found their no-till system is far more resilient. They aren't delayed planting in wet springs and drought has less impact on the crop as soils improve.

Categorical Trends in No-Till & Cover Crop Systems in Vermont*

Yield	+	• amount and/or quality of crops increased • consistency in yields (less reactive to weather and other conditions)
Seed Costs	+	• Cover crop seed is an additional cost • Quality crop seed is important when using no-till in the northeast • Often farms need to utilize herbicide resistant seed
Fuel	-	• One farm reported a 30% fuel decrease • Another farm reported $600 annual savings
Herbicide	- / =	• Less expensive materials needed • Less passes
Fertility costs	-	This is variable and had other factors contributing to it. Most of the response was driven by adoption of Nutrient Management practices as well. It also depended on manure usage. Soil Organic Matter going up, yields go up, fertility needs to go up too.
Equipment Maint. Costs	-	Tillage equipment is expensive to maintain, operate and repair. Less tillage = less costs here
Manure	=	Costs not directly tied to cover crops or tillage
Labor/Time	-	• One farm reported eliminating two field passes to get corn planted • Another farm reported reducing 1.25 days of labor during planting • Cover crop can sometimes be incorporated into other passes, reducing the addition of overall labor/equipment time • Another farm reported reducing labor by 3 people during the cropping season, reducing 3 passes in fields and needing less equipment

*The table above reflects the information gathered during a two-year project with farms in Vermont. This was collected through conversations with individual farmers and survey results from farms attending UVM Extension's No-Till & Cover Crop Symposium.

Challenges | Future Goals | Reminders

George found fitting cover crops into the soybean rotation can be a challenge with late harvest. While he tried interseeding clover, results were inconsistent. He hopes to try a rye/oat/white clover mix at leaf drop moving forward.

Avoiding compaction is more important than ever. This is particularly challenging when working with liquid manure applications, and the Fosters use dragline surface applications whenever possible.

Be patient! No-till fields can be deceiving. Because of increased soil structure, they might seem fine when pulling in the field but may still be too wet to plant under the surface.

Keep learning and gathering new information. Go to conferences and workshops and be willing to adopt new technology. Engage in research, and be willing to share your results with others.

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REFRERENCES:

Cartwright, Lauren and Kirwan Byron (2018). *Cover Crop Economic Tool, version 3.1.* USDA Natural Resource Conservation Service.

**all pictures in this publication were taken at Foster Brothers Farm Inc. by K. Workman , UVM Extension.*