

# ORGANIC COVER CROP CASE STUDIES



## Paul Hoffman

<b>Farm location</b>	Earlville, IL
<b>Certified organic acres</b>	225
<b>Total acres</b>	225
<b>Year of initial organic certification</b>	1998, re-certified in 2014 (Oregon Tilth)
<b>Primary cash crops</b>	Corn, soybean, winter wheat, oat, pea, canola, sunflower
<b>Years planting cover crops</b>	Since 2012
<b>Frequently used cover crops</b>	Oats, turnips, red clover, peas, Winfred forage brassica (a cross between kale and turnip), annual rye, buckwheat, sunn hemp, sorghum sudangrass, pearl millet
<b>Livestock on farm</b>	Cattle and sheep
<b>Soil type</b>	Black, deep, poorly drained soils; mostly silty clay and clay loam with predominantly clay sub soil

## Brief Farm History

Hoffman manages a 225 acre farm with his mother. He has worked the land since 2005. Most of the farm has never been 100% conventionally managed. His father, a dairy farmer, transitioned from row cropping in the early 1980s and re-introduced forages and grazing of cattle at that time. His father purchased corn when needed, rather than producing it on the farm. Therefore, herbicide and insecticide applications have not been used since 1983, and only a small amount of commercial fertilizer has been applied since then. The farm was certified organic from 1998-2005.

After Hoffman's father passed away in 2005, the land was seeded in perennial forage and organic certification lapsed, though no non-organic inputs were used during that time. Hoffman re-certified the farm in 2014.



Today, Hoffman and his mother balance the farm's crop rotations between livestock and row crop needs. His mother owns 40 head of breeding stock cattle while Hoffman manages the field crops. On average, two-thirds of the land is in row crops and one-third is in forage grasses or alfalfa in any given year. They have lengthened the duration of both rotations, from three years to six or seven years on row crops, and have increased the forage crops from two to four years. In addition, Hoffman and his wife have 15 breeding ewes and direct market grass-finished lambs.

## Cover Crop Use & Goals

Hoffman's first experience with cover crops was in 2012. Prior to this, all acreage was in perennial forage for pasture. After a winter wheat crop was planted in the fall of 2011, the original intention was to re-seed the field to alfalfa in August 2012. However, that summer was very dry and the chances of the alfalfa establishing were low. Having heard about utilizing oats and purple turnips as a forage, Hoffman decided to plant this mixture instead of the alfalfa. With some decent moisture in September, the field became a great fall grazing crop. **He attributes his early positive experiences with cover crops to their forage benefit.**

Hoffman's biggest challenge with cover crops is timing. During harvest season, he struggles to complete field operations, as well as seed covers as

early as he would like. If Hoffman didn't have livestock, he feels managing large amounts of cover crop biomass would be an issue. Since 2012, Hoffman has tried several cover crops. His general management approach is to plant a cover crop in the fall and graze it the same fall. He does not like the cover crop to accumulate significant fall biomass, as he feels this keeps the soil too wet and makes it difficult to dry out in the spring. With grazing occurring as late as December, Hoffman aims to leave half to one-third of the cover crop biomass on the ground over the winter to provide soil coverage and ensure that forages survive the winter.

**For Hoffman, one of the biggest benefits of cover crops is forage for his livestock. This feed value more than pays for the cost of the cover crop.** However, there can be challenges with grazing during periods with excessive rainfall if fields get too muddy and livestock damage plants. When cereal rye is seeded at the right date for crimping, Hoffman saves the money and time associated with the elimination of four weed control passes in the subsequent soybean crop. He has also seen increased water infiltration and more earthworms in fields following cover crops.

## Crop Management

### TYPICAL ROTATION

Hoffman re-introduced grain corn on the farm in 2014. Since then, they



follow a corn, soybean, small-grain rotation, but ultimately there is no “set” rotation on the farm. Corn is the cash staple in their rotation. Two rotations they use heavily are corn/soybean/corn/oat-pea with alfalfa as a nurse-crop that they cut for forage. They also commonly use the shorter rotation of corn/soy/wheat, which they repeat twice, before rotating into forage. Hoffman has also shifted his rotation with the markets. When soybeans are forecasted to be more profitable, he often plants a soy/corn/soy rotation. He has had some success with no-till soybeans seeded into crimped rye, but consistently establishing rye early enough after corn grain to roller-crimp the following year is a challenge.



*Field of sorghum sudangrass*

Recently, due to a new canola contract, Hoffman is experimenting with planting winter canola after terminating perennial forage. The canola is harvested in the summer, creating a

longer window of time to plant cereal rye, or potentially a warm-season summer cover crop. If successful in his rotation, the winter canola will be another option for a mid-summer harvested crop, an option he hopes to be more profitable than wheat.

Hoffman has also started growing sunflowers as an oilseed crop. Marketing and weather risks are a challenge with sunflowers, but their shorter growing season allows for either late termination of a spring cover crop or a much earlier planting date for fall planted cover crops.

## **FIELD OPERATIONS**

Hoffman is shifting away from relying on the moldboard plow to using a disc and field cultivator more often. Although using the moldboard is the quickest way to terminate a crop, Hoffman is looking for similarly effective options that cause less soil disturbance. He has found a disc and field cultivator can manage most biomass situations.

Last year, Hoffman bought a rotavator, but finds it to be slow, uses a lot of fuel (speed and fuel use similar to moldboard plow), is high maintenance, and greatly disrupts the soil structure of the top two inches of soil. However, he feels it is an improvement over a moldboard plow followed by several secondary tillage passes. The rotavator can keep tillage very shallow, just two to three inches deep, with the soil below this depth experiencing minimal



disturbance. Hoffman finds using two passes of the rotavator, or one pass with the rotavator followed by a field cultivator, approximately two weeks apart, effectively terminates cover crops and prepares the soil to plant with the least overall soil disturbance.

When managing his perennial forage crops, Hoffman prefers to terminate them in late July or August because the soil is drier to work and the plants desiccate well. The rotavator works better than the field cultivator in this scenario, again with the least soil disturbance. Hoffman finds it is better to err on the side of caution and terminate the perennial forage a year too soon, rather than a year too late. When the forage slows down, quackgrass and thistle establish as problem weeds.

**Hoffman sometimes seeds a winter cash crop, such as wheat or canola, after terminating a forage crop. Then in the subsequent year, he seeds cereal rye after canola or wheat harvest to crimp for soybeans the following year.** He has been working with a new cropping sequence to seed rye immediately after killing the forage in late July-August. He can then crimp the rye the following spring for no-till soybeans.

Hoffman's first flush of weeds in the spring generally consists of common ragweed, lambsquarter, a few pigweed and velvetleaf. He manages these

weeds with a spring cultivator. Hoffman considers his techniques to be partly stale seeding and partly waiting for these early varieties to be done with their spring germination window. In late May, more velvetleaf, pigweed and jimson weed appear. Within his weed seed bank, velvetleaf is his biggest issue. He manages it before August with cultivation and cover crops. Hoffman has found that if velvetleaf germinates after August 10th, 90% of the time, a freeze will kill it before it sets seed.



*Buckwheat with monarch butterfly*

Hoffman likes to plant corn following a fall or spring planted cool season cover crop mix consisting of oats, 4010 forage pea, Winfred brassicas, sunflower, and buckwheat. He will scratch the soil with a disc to size the cover crop residue, field cultivate one or two times, and then plant corn. Corn is rotary hoed twice and then cultivated twice. After corn, if he is going to seed oats in the spring and go back into perennial



forage after the oats, Hoffman may not perform fall tillage after corn and instead will run his livestock to graze the corn stalks.

To prepare fields for soybeans, Hoffman ridges corn on the last cultivation and then runs a disc to scrape the tops off the ridges before planting the cover crop. He will drill a grain cover crop, usually winter rye or winter triticale, or sometimes winter wheat, if he has extra seed. If he has a strong stand of winter rye biomass in the spring, Hoffman will no-till plant soybeans and crimp the cover crop. **If there is too little biomass for weed control for no-till beans, he will mow and bale the rye for feed.** If conditions are ideal, he will then run the rotavator to clear the rye stubble. After 10-14 days, he'll run the field cultivator prior to planting soybeans. He may use the rotavator for the pre-plant finish pass. His soybeans are usually rotary hoed two to three times and cultivated two to three times.

### **NUTRIENT INPUTS AND TIMING**

Hoffman applies pelleted poultry litter, bedding pack manure from their cattle and sheep, potassium sulfate, and high calcium ag lime, as needed, to meet nutrient goals for his cash crops. Hoffman spreads poultry litter when there is a dry window in the spring, ideally two to three weeks ahead of corn planting. He rents a spreader cart for applying the litter and potassium sulfate together. He spreads the lime on summer cover crops during dry

conditions, as there are less logistical concerns than during spring, when time and labor are limited.

### **SEEDING AND ESTABLISHMENT**

Most cover crops are planted with a drill. Hoffman is experimenting with broadcast inter-seeding of cover crops at the last cultivation on corn, after having broadcast covers with a spreader post-cultivation for several years. Recently, he has improved his technique to mount the spinner on the tractor to spread cover crop seed while cultivating. This has provided a slight bump in seed germination, while eliminating a trip across the field.



*Red clover after harvest*

Hoffman often finds the “tried and true” method of frost seeding red clover into winter wheat does not always meet his expectations. Due to a high pressure of Canada thistle and quackgrass, Hoffman notices a weed resurgence under the small grain canopy. As the red clover is slow to establish when seeded into



a standing wheat crop, the thistle, in particular, often outcompetes the red clover. However, Hoffman does like interseeded red clover because it tends to do well even in dry years. Once it gets a strong start, it persists and often thrives, in times of midsummer water stress when it would otherwise be difficult to establish a warm season cover crop after wheat harvest.

As an alternative to red clover, Hoffman likes combining cover crop mixtures of oats, 4010 forage peas, and Winfred forage brassica. He has also added buckwheat to this blend. The buckwheat may produce volunteer seed the following spring, which he likes to allow to grow four to six inches before tilling and planting corn.

## Advice to New Cover Croppers

Hoffman shares, “Don’t do everything all at once. Make sure your train wrecks are small enough that you can learn from them; that they teach you instead of sink you.” **His suggestions for getting started with cover crops are dependent upon rotation.** If small grains are in the rotation, he suggests brassicas as an ideal complement. He prefers turnips or hybrid rapeseed over radish because they provide more seed than radish. If someone is drawn toward peas for the nitrogen credit, Hoffman recommends using cover crop mixes for increased nodulation. In his experience on fields with a manure

history, peas don’t nodulate well, even with inoculant. A diverse cover crop mix will help increase nodulation. If money is not an issue, Hoffman loves lots of cowpeas! Increasing warm season species is beneficial if fall is warmer than average, but the extra cost isn’t worth it if fall ends up being cool. If velvetleaf is not a weed pressure, sunn hemp planted in late July is a nice option.

**Hoffman relied upon information from OGRAIN and MOSES to get started in cover crops. He now mostly follows cover cropping on social media, such as Twitter. These social media posts on cover cropping highlight innovative ideas, different establishment practices and they dig into the specifics of seed/variety selection.** For example, one idea Hoffman is interested in is relay cropping. He would like to try it in organics, but has not yet seen it work without herbicides. He has begun to experiment and sees some potential for future relay cropping strategies on his farm.

## Looking to the Future

Hoffman dreams of having something green growing every day of the year, so that living roots continually provide optimal benefit to the land. He also aspires for his cover crop program to increase the profitability of his operation.



Hoffman likes to try new things and appreciates the value of experimenting and research. He has a five acre block where he is trialling complex intercropping and solar corridors. In this area, he is comparing corn yield between 30 inch rows, two paired 30 inch rows with a skip, and straight 60 inch rows. In the missing corn row width, he is researching different combinations of covers and food crops. Hoffman jokes that these systems are not going to win a corn yield contest.

He has observed a five to ten percent corn yield reduction with one corn row skip and a six to 25 percent yield drop in 60 inch spacing. He attributes the range of yield reduction to the difference in hybrids, as he was trialing two different hybrids in this design.

**Two food crops Hoffman is trying in the skipped corn rows are butternut squash and snap beans. He is experimenting with how he can increase the planting density of the two rows of corn, with the one skipped row being in butternut squash, snap beans or another form of dry edible bean to result in higher overall per acre profitability than a simple monoculture of corn.**

Agronomics and harvest solutions are needed for this new system, but Hoffman sees promise.

In his own words, “The great frontier in cover cropping is increasing diversity and converting covers into grazable feed or higher value food crops.” For example, he loves the potential of squash in the rotation. He is currently investigating the economics of one acre of butternut squash producing a half ton of product to the value of one acre of corn. In this experiment, on the last cultivation of corn, he seeded buckwheat, cowpea, cereal rye, and berseem clover. With the first frost, the cover died except for the cereal rye which provided four to six inches of grazing for his sheep. This grazing value made up for half of the corn yield loss and Hoffman is hoping the squash value will make up the other half of the difference.

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