

## 004 Soil Health Leading up to Potato Production

*Regenerating soils after potatoes and building them up for the next potato crop*

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Potatoes can be a tough crop to integrate into your crop rotation when your goal is to maintain and improve soil health. In a companion episode, I went through common hurdles and potential solutions to maintaining soil health in the year of potato production. In this episode, I'm focusing on the rotational years between potato years.

Unlike standard, low disturbance crop rotations, the goal in this system is going to be to over-compensate for the coming disturbance year. It's not about getting to a particular organic matter number; it's about getting a proper flow of carbon through the system.<sup>1</sup> The goal is to build a bank of carbon ahead of the potatoes so that it can be spent while growing them.

If the economics of your system means that potatoes give the greatest return, you can afford to spend more money investing in the soil and worry less about returns in the intervening years. However, you may need to maximize returns in each crop year in which case your goals will change. It's never an easy decision, and it's never straight forward but choosing to invest in the soil when you are able to will help you to draw on it when you cannot.

### **Cash crop systems after potatoes**

One place to start building your soil is the period directly after potatoes. You may be able to establish a winter cereal crop such as winter wheat or fall rye. This could be planned as a cover crop that will be terminated in the following spring, or it could be planned to be left as a cash crop. The advantage to planning this as a cash crop is that it will be one of the first crops to be harvested in the following year and gives a long season to establish and grow cover crops that build the soil.

A well-proven system for building the soil is to grow red clover in a winter wheat crop<sup>2</sup>. It can do great things for the soil and the following crop, but the establishment can be tough. If the crop is weak, the red clover can overtake it. If weed pressure is high, it can be tough to control the unwanted plants and favour the wanted plants.

Perhaps some new thinking can be applied to make this work. As mentioned in the companion podcast, corn growers are working at establishing a cover crop in the corn just before row close<sup>3</sup>. What if wheat were planted on wider rows and this area in between could be seeded with a cover crop once the weeds were controlled? Some growers are trying ultra wide corn which is 1.5m row widths! The experience so far is that there is a 5% yield loss, but there can be 2-4x the amount of cover crop growth.<sup>4</sup>

While wide rows may result in less cash crop yield, remember that it's not about getting the most crop off the soil. It's about building the soil up and still getting a return on the crop. Also, think about the system. If the red clover (or any other cover crop mix) produces nitrogen that the following crop can use, expenses are down.

How long the cover crop is left will depend on the planned cash crop for the following season. It may be best to kill before winter if it will overwinter and cause problems at seeding the following year. On the other hand, having a living crop growing in the spring may help to draw down water and aid in planting the cash crop. At some point, it will need to be killed, and this will need to be factored into the system.

As an alternative to using the fall planted crop after potatoes as a cash crop, consider using it as a nurse crop. Planting soybeans into fall rye is showing the great promise as a way to control weeds without chemicals and to provide some extra cover for a crop that leaves very little after<sup>5</sup>. Soybeans are nitrogen fixers, so fall rye also has the advantage of using up most of the free nitrogen in the soil. As the soybeans develop, they get the cue to maximize nodule production and so will give you a crop with no nitrogen input. The fall rye may give back some nitrogen later in the growing season, and if it does, it's a bonus for the soybeans, not a detriment. If the following year's crop is an early seeded crop, the field could be left after the soybeans with a cover of the rye and soybean stubble holding it in place. If there's time to establish a cover and it fits with the following cash crop, try to establish something.

### **Integrating animals after potatoes**

An alternative to establishing a fall cereal crop or nurse crop after potatoes is to establish a cover crop designed for grazing. If there's not enough season remaining to establish the species desired in a cover crop, it could be planted in the fall and then the ideal mix planted in the spring. There is potential in this system to let the plants and the animals do the compaction busting tillage if it can be established as the potatoes are maturing (see the companion episode) or immediately after harvest. Don't underestimate what plants can do. If the breeding efforts looking for cash crops were spent on cover crops, we could potentially have plants ideally suited to establishing in tough conditions and able to do things we've never thought of.<sup>6</sup> Think of the first radish breed specifically to break up hardpans – the Tillage Radish.

Grazing helps to build the soil in many ways. The saliva from the cattle introduces new microbes to the soil system. The act of removing some of the above-ground growth stimulates the plant to keep growing vegetatively and keeps it pumping carbon down into the soil for the microbes<sup>7</sup>. When done properly – taking no more than half of the growth – it doesn't affect root growth and maximizes new shoot growth<sup>8</sup>. Manure and urine are added to the soil, and some economic activity can be gained, whether you think of it as less feed needed for the animals or weight gained to the animals.

Mowing can have a similar effect on soil health if you cannot have animals on your land. Most of the Canadian seed canola is grown in Southern Alberta, Canada. A strip of male plants taking up about 25% of the field is placed between a bay of female plants. The males are clipped 2-3 times in the year 30-60cm from ground to stimulate flowering and ensure a long window of pollen for the females. Once flowering is complete, the males are mowed down to ground level, effectively killing them. In the following year, I've sometimes noticed crops growing more vigorously and for slightly longer in these strips. I've taken paired soil samples in the male & female bays, and I've never seen a difference in nutrients. It's something in the biology that is

changing that isn't captured on a standard soil test. Now that I have a soil health testing lab in my area, there may be an opportunity to find out what is going on.

### **Looking at the full rotation cycle**

Thinking through the rest of the rotation, look for ways to always have a living root for as long as possible. The reason for this is that the living root, pumping down carbon for the microbes below, is what develops the soil. It may seem the plant is giving up too much, but they will never give without getting. The microbes help them by supplying nutrients more efficiently than the plant can do on its own and even mining the soil minerals when it can't be found in the system. When cover crops do this, all the mined nutrients are returned to the system and, in time, will be available to the cash crops.

You might think of planting a barley crop intended for greenfeed (to use yourself or to sell to neighbours). Immediately after it is harvested a warm-season cover crop could be planted to establish in the soil quickly with some cool-season species can be mixed in to take over in the fall.

Think through the rotation cycle. Which crops can be matched up? Could an early harvest crop have a cover crop established and let it grow into the next spring before a late-seeded crop? Could you follow your late harvested crops with an early seeded one that allows a cover crop? Could a perennial crop be established for the next few years?

Now to think entirely differently – what about intercrops? There is renewed interest in intercrops. Many farmers are experimenting with them, and researchers are trying to study them<sup>9</sup>. The concept is to grow two (or more, but let's not get complicated here) cash crops at the same time. Yellow peas and canola are a popular choice here in Canada and even have their own name – peola. These crops work well together because sorting the seed at harvest is relatively easy due to the very large difference in seed size.

In most cases, the total yield from both crops is greater than the monocrop. They seem to be best in lower fertility systems. It seems counter-intuitive, but it appears the legume which is the pea in this case gives nitrogen to the canola. It's also possible that the canola is drawing on leached nitrogen deeper down in the shallow-rooted peas that cannot access it.

Coming to the year immediately before potatoes, most any of the strategies above could be used, but you need to think through what you want when the fall comes. When you are forming the hills, you want the soil workable. If you want to have green material mixed into the hills, you'll need to have a way to chop and mix it prior to creating the hills.<sup>10</sup> The year prior to potatoes may not be the best year to growing lots of biomass. It may be best planned on as the year to ensure stable aggregates and deep soil loosening that allow for the least amount of disturbance in creating the hills. If you are an organic producer, this could be the time to building nitrogen supplies in the soil. If you are a conventional grower and have a good system for fertilizing the potatoes, this may be a good time to draw down the supplies so that nitrogen release can be timed properly across the growing season.

### **Summary**

In this podcast, I've covered what you can do in the years between potato crops. I encourage you to think of starting right after the diggers have passed over the field (if not before it, as I explained in a companion episode). Whether you grow cash crops or have animals to integrate into the system, there are many options to start repairing the soil immediately. Throughout the remainder of the rotation, the bias has to be on building the soil to be ready for the soil disrupting event.

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This podcast was originally published at:

<https://www.scottgillespie.com/posts/2019/8/15/soil-health-leading-up-to-potato-production>

It has since been moved to:

<https://www.plantsdigsoil.com/podcast/004-soil-health-leading-up-to-potato-production>

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<sup>1</sup> Andrew McGuire. 2019. Soil biology and soil organic matter; What do recent discoveries mean for soil management? <http://csanr.wsu.edu/soil-biology-and-soil-organic-matter/>

<sup>2</sup> John Heard. Manitoba Agriculture. Underseeded Red Clover in Winter Wheat. <https://www.gov.mb.ca/agriculture/crops/soil-fertility/underseeded-red-clover-in-winter-wheat.html>

<sup>3</sup> University of Wisconsin Integrated Pest and Crop Management. 2015. Interseeding cover crops into corn in Wisconsin: Can it work? <https://youtu.be/ipw2lsyYZ0E>

<sup>4</sup> Bob Recker. 2018. Wide Row Corn Test Plots. <http://cedarvalleyinnovation.com/>

<sup>5</sup> University of Wisconsin Integrated Pest and Crop Management. 2016. Early soybean planting into rye cover for organic no-till. <https://youtu.be/15Wrzy5sYgE>

<sup>6</sup> Risa Demasi. 2018. Cover Crop Corner. Using legumes to reduce nitrogen fertilizer costs. <http://www.grasslandoregon.com/using-legumes-to-reduce-nitrogen-fertilizer-costs.html>

<sup>7</sup> Debra Murphy. 2018. Cover crops and livestock trampling 'part of the rotation equation'. <https://menokenfarm.com/cover-crops-livestock-trampling-part-rotation-equation/>

<sup>8</sup> Gabe Brown. Grazing on Brown's Ranch. <http://brownsranch.us/grazing/>

<sup>9</sup> Brian Coss. 2018. The Western Producer. Intercropping canola and peas shows increased returns. <https://www.producer.com/2018/08/intercropping-canola-and-peas-shows-increased-net-returns/>

<sup>10</sup> USDA NRCS East National Technology Support Center. 2014. Managing for Soil Health when Raising Potatoes - A Farmer's Perspective. 33:06-33:59 <https://youtu.be/GES07e7ZqyA?t=1986>