

An Agronomist's Perspective to Organic Farming of Potatoes

Organic Farming is not new and has been practiced by several farmers in Idaho for over 30 years. In Idaho, the acres dedicated to organic farming have been low, well under 1% as compared to conventional farming acres. From 2012 and forward, the amount of acres dedicated to organic production is growing. The consumer demand for organic products are one of the stimuli's that has helped the growth of organic farming.

In the past, I was involved with Organic Farming mostly through meetings, some financial support of the meetings, purchasing of organic products at super-markets and farmers markets, and to a lesser extent, my small garden. That changed in 2015, where I had the opportunity to work with Wada Farms in Pingree, Idaho on their newly developed and on-going organic farming enterprise. Wada Farms first year in organic farming was in 2015 where about 180 acres were devoted to potatoes--reds, yellows, and russets. I do not have the authority to delve into all of their farming practices, but I will cover some of the issues involved in organic farming. First I will start with the fears of organic farming.

The Fear of Crop Yield Losses—many farmers equate organic farming with yield losses due to the lack of conventional fertilizers and pesticides. Some feel you apply a bunch of compost, use cover crops, and then farm for the best. That assumption isn't totally true. An organic product certifying organization called OMRI has certified over 3,000 products that can be used by farmers for organic production. We used OMRI listed fertilizer products such as a 5-5-2, meaning 5%N, 5% P₂O₅, and 2% K₂O. We matched organic fertilizer needs with soil tests along with choices of fertilizer efficient potato varieties. The organic yields were fine and very close to yields of the same red and yellow varieties raised conventionally.

The Fear of Inferior Crop Quality—crop quality in our organic system was equal to the conventional system. For conventional potatoes, a 'bigger' potato is often required such as boxes supplying potatoes at 8 ounces or bigger. In organic systems for potatoes, it appears that potatoes in the sizes that fit in 3 pound to 5 pound bags is where the demand is. Thus, the two systems are slightly different. To raise organic quality potatoes requires the same techniques for potatoes grown conventionally. That is, irrigation scheduling is the same—don't over or under water. Do not compact your soil during spring tillage or at planting, harvest when weather conditions are appropriate, have proper storage conditions, and so forth.

The Fear of Weeds—weeds will always be around. They got started thousands of years ago when a farmer first tilled his soil and planted seeds for a crop. With seeds, comes weeds. It came with birds that ate seeds in one area and deposited them in another area, miles away. Weeds are the hitch-hikers of seeds. Weed seeds float in canals, they float down rivers. Weeds in a field are a guarantee. People who say they have weed free seed are wrong. Even the rare seed analysis of 99.99% pure has weeds. There is no such thing as 100% clean seed. If so, give me a bag of it and I'll find some weeds for you. I have even germinated several weeds on seed potato tare dirt. Weed control is an issue for both conventional and organic farming.

Weed control is where conventional farming has its big advantages. There are numerous herbicides conventional farming can use for adequate weed control—not so with organics. In organics, the few organic herbicides available are pre-crop emergence and weed burn-down only. Once an organic crop emerges, then there are no organic herbicides available for weed control.

It does take additional tillage practices and strategies to keep an organic potato field as weed free as possible. Troy Watt, organic farm manager for Wada Farms, did an excellent job at keeping the fields relatively weed-free through timely tillage. The keys were deeper tillage in fall or spring, and shallow tillage during the crop growing season. In shallow tillage, it was key to till when weed seeds sprouted but had not yet emerged. Once weeds emerged, it can be too late for adequate weed control. Weeds must sprout, but not emerge in the early plant growth stages.

The Fear of Costs—before we began the organic farming enterprise, we were told by many ‘experts’ that organic farming to get the same yields and quality as conventional could cost anywhere from \$400 to over \$1,500 more per acre than conventional farming costs. Our first year was maybe \$200 above conventional costs. We didn’t fight any bug issues such as Colorado Potato Beetle or Army Worms in 2015. If we would have, then costs could have easily increased \$300 per acre. Conventional farming of potatoes has the advantage on insect pest management through systemic insecticides used at seed cutting time. The cost of systemic insecticides are relatively low and provide insect control for at least 70-90 days. Not so with organics. If insects or plant diseases become a problem, then costs to combat those will rise.

The Fear of Pests and Diseases—the fear of pests and diseases is real in that there are less organic registered products to choose from to combat pests and diseases. If late blight strikes potatoes in an organic field, then the options are limited for organic products to battle late blight. The best action to prevent diseases and pests are through rotations, variety selections, alluring beneficial insects, irrigation management, and an elevated knowledge of how these disease cycles come in in the first place, ie., the disease triangle.

The goal to disease and pest management is to develop biological diversity to promote soil health and eco-health. By eco-health I am referring to the above ground environment (plant environment) where beneficial insects and other beneficial biota thrive. You must create an environment where your crop is less susceptible to soil borne and plant diseases. For instant, it is known that root knot nematode can damage potatoes in a normal environment. But a soil that is teeming with beneficial organisms and active organic matter may have those same root knot nematode levels and show no visible damage to potatoes grown in an organically managed system. Healthy soils can ward off or suppress soil borne pathogens. This is the old predator versus pray ratio. A soil with a higher beneficial to pathogen population can sustain itself better than a soil with a lower beneficial microbial population. Beneficials live off the soil, organic matter, and pathogens. While pathogens live off of your crop.

You must create a new ecosystem that is centered towards soil health and plant health. Two resources that might be helpful are the Organic Farming Research Foundation (www.ofrf.org) and the Xerces Society (www.xerces.org).

For me, I monitored soil health through 5 variables:

1. Earthworm counts
2. Soil Organic Matter Content and Quality
3. Soil Carbon Dioxide measuring biological activity
4. Soil Testing of the Soil N Cycle—Ammonium and Nitrates
5. Soil test of nematode community—beneficial and plant parasitic nematodes

I measured plant health through 4 different variables:

1. Plant Health through observations, chlorophyll analysis, and tissue analysis
2. IPM Scouting
3. Digging potatoes during the summer for size and quality
4. Implementing the yellow 'Sticky Traps' to monitor beneficial bugs and pests

The yellow sticky traps helped us monitor the ratio of beneficial bugs versus plant parasitic ones. Unfortunately, in year one, we had very few lady-bugs and other beneficials. Our sticky traps captured mostly thrips and aphids. We will need to figure ways to allure beneficials in the future.

The Fear of Markets—markets for organic products have increased steadily over the past 15 years. Don't raise organics openly. You need to make sure you have a market before raising organic potatoes, or any organic product. Quality potatoes are far more important than a high yield with less quality. You really don't want to raise 450 sacks with a 50% pack-out. That means 50% goes to the processor and the processor will pay whatever prices are for any potato (unless they have a contract for organically grown processed potatoes). So you need to develop a market and keep and increase that market through crop quality and consumer demand.

The Use of Compost—compost comes in all kinds of quality. It is not a guaranteed analysis like fertilizer analysis. You can have salt contents as low as 4 or above 15. It can come fully decomposed, or it can come with visible straw and undecomposed cattle manure. The loads are not always the same. My opinion is that in potatoes an organic farmer should apply compost to fields where at least 2 years of wheat will be raised before the potato crop. By then, the compost will be decomposed and the values picked up in a soil test. Then a farmer can adjust their organic fertilizer needs based on the available nutrients from the compost applied 2-3 years previously. My opinion, I wouldn't apply compost on the year potatoes are grown. Potato quality can be affected by salt content. If compost is applied 2-3 years before potatoes then all salts should be diluted and the composted products broken down into their organic forms.

The Use of Cover Crops—cover crops are nice and help build soil structure and organic matter. But cover crops can be over-sold. I sell a cover crop myself, only one, an oriental

mustard PVP variety called Pacific Gold, bred at the University of Idaho. I tried other varieties and felt I got burned. The overselling of cover crops is in the form as a 'cure-all' to all soil health and environmental problems such as soil and groundwater quality. Growing a cover crop and tilling it back into the soil does require energy. Cover crops also require water, which is limited in some areas. For potatoes, my opinion, the best time for a cover crop is following harvest from the wheat crop the year before potatoes will be planted. The cover crop, such as Mustards, can be no-tilled in the standing wheat stubble. Once the mustard reaches about 3 tons, around when yellow flowers appear, the mustard can be mowed and tilled into the soil with the standing wheat stubble and along with the volunteer wheat and weeds.

The Positives of Organic Farming—the main positive variable of organic farming is that no pesticides are used. This is both human friendly and environmental friendly. Also, the fertilizers used are in the organic form which takes longer to break down in the soil into the plant available forms of nitrates or ammonium. Nitrates move readily as a soluble product in water. Where water goes so goes the solutes and nitrates. Thus the organic fertilizer formulation is water quality friendly due to a lower leaching potential into groundwater systems. Conventional fertilizers take about 2-10 days to go from their ammonium form to their nitrate form, depending on the environment (there are conventional fertilizers available in the slow-release form). Organic fertilizers take at least 21-35 days to do the same. I was impressed with the small amounts of organic fertilizer applied, less than 100 units N, and the yields that we did get. There is a nice match between fertilizer efficient varieties, organic fertilizer, and organic quality yields. To be fair, the fertilizer industry is formulating NPK fertilizers in a slower release form using conventional fertilizers. This will also slow down the release of fertilizer nitrates in the soil environment.

The Negatives of Organic Farming—about the only negative side I see to organic farming is fuel and hand labor. That could keep food cost higher than what most people are willing to pay. For potatoes, we used more fuel versus conventional practices primarily for the additional cultivations for weed control.

Conclusions—the biggest conclusion is that organic farming is just farming, nothing more and nothing less. You just go farming, but farming with a set of State and USDA regulated rules that separates your product as certified organic versus other products grown conventionally. There are many resources to draw from and learn about Organic Farming. To name a few, NCAP at www.pesticide.org OMRI at www.omri.org or ATTRA at <http://attra.ncat.org>. Or you may contact Johanna Phillips at the Idaho State Department of Agriculture, if in Idaho.