Growing My Own Organic Nitrogen

Jake Guest
Killdeer Farm, 55 Butternut Road, Norwich, VT 05055
Jake.Guest@wavecomm.com

My wife, Liz, and I have been farming in Norwich, Vermont since 1979. We farm approximately seventy acres, mostly alluvial soils ranging from light sandy soils to heavier silt loam. In any given year usually no more than half of those acres are occupied by vegetable crops, the rest being in cover crop and green manure rotations, straw, and fallow or buffer areas. For over twenty years most of our crops have been certified organic; the exceptions being our sweet corn and greenhouse bedding plants.

As on any vegetable farm, good soil fertility has been a major concern, and regular soil testing has been an important routine on the farm. I have relied heavily, especially since being certified organic, on locally purchased dairy manure as well as various amendments such as sulfate of potash magnesia, lime, and trace minerals. I have also used raw hen manure from time to time.

With the introduction of stricter standards for using raw manures and compost I have in the last several years found it increasing difficult to include raw manures in our fertility program. This has resulted in more extensive use of bulk composted hen manure from a large poultry farm. It contains a wide range of nutrients and is especially rich in nitrogen, phosphorus and calcium. I also produce large quantities of compost using the composted hen manure mixed with various carbon-rich materials such as leaves and purchased waste silage and haylage. Both the straight composted hen manure and our own compost have proven very useful for successfully growing a wide variety of vegetable and soil building crops.

However, there has been a down side to using these materials: over the last several years soil tests have indicated an excessive accumulation of some nutrients, especially phosphorus, and a steep rise in pH readings. Many of our fields now have a pH of over 7. The obvious solution would seem to be to cut down on the amount of composts applied to our fields. However, when I have attempted cutting back on compost, lack of nitrogen has become a limiting factor. Past use of appropriate amounts of Chilean nitrate has helped alleviate this problem, but with the likely ban of this fertilizer the need for adequate nitrogen has become critical. There are many fertilizer materials available for organic production, but with the exception of Chilean nitrate most of them also contain the same nutrients that have become excessive in our soils and are therefore not appropriate.

Two years ago I concluded that a possible solution for our farm was to try and grow our own nitrogen. Although I have often grown leguminous green manure crops in our rotation, I have never seriously considered growing a cash crop relying solely on a prior green manure crop for its entire nitrogen requirement. We are fortunate in having enough available land to implement longer rotations including leguminous green manure crops so I began to experiment with several different combinations of green manure crops followed by cash crops.

My first step was to review my most current soil test results to determine which fields had especially high non-nitrogen fertility levels and would therefore be suitable for these trials. I then chose a few different crop combinations which I thought might achieve the goal of growing enough nitrogen for the following cash crop. I have relied primarily on a winter rye/hairy vetch mix, a field pea/oat mix, and a field pea/winter rye mix. All the legumes were inoculated with their appropriate inoculant. Cash crops were later season crops such as late potatoes, cole crops and fall greens, planted or transplanted after near maturity of the green manure crop.

Winter Rye/Hairy Vetch : Seeded rye at approx. 100# and vetch at 30#/A in early to mid-September after summer cash crop or fallow; allowed to grow in spring until rye was in full flower; mowed with flail mower; plowed; rotovated or harrowed; and planted cash crop when residue was sufficiently broken down. In the fields where this was tried, the mix, when allowed to grow nearly to maturity, produced a lush and thick mass of green matter which subsequently broke down fairly rapidly. Weeds were nearly completely suppressed and there were extensive nodules on the vetch roots. In all fields subsequent plantings of heavy feeding crops such as potatoes, broccoli and fall spinach showed no signs of nitrogen deficiency whatsoever. No additional fertilizer was used.

Rye/Vetch, two cycles: A variation on the above is to let the mix grow completely to maturity before flail mowing twice. The huge mass of rye and vetch seed germinates under the thick residue cover even without additional incorporation, and will grow through late summer into fall. The result is a dense mass of old residue and new growth. The soil underneath is always moist and open and I have noticed abundant earthworm activity. The field is plowed in early November. Crops grown the following spring did receive some early supplemental nitrogen (20-30#N from Chilean nitrate, but later growth was vigorous and showed no N or other nutrient deficiency. In the future I plan to try waiting until spring to incorporate the overwinter rye/vetch. I did discover, however, that the residual vetch seed remains viable for at least two years and can become a very troublesome weed. I have solved this problem by using this sequence only on fields where large transplanted crops are grown or on non-organic sweet corn where an herbicide is an option.

Field Peas/ Oats: Seeded as early as possible in the spring, this mixture, when allowed to grow to full pea flowering stage has provided enough nitrogen to support subsequent heavy feeding crops. Seeding rates were approx. 60# of oats and up to 100# of peas. Seeds were sown separately with a spin spreader because the heavier peas tend to spread much wider than the oats.

The mix was flail mowed soon after the first pea flowers formed small pods and then rototilled to incorporate. (In one planting I made the mistake of letting the peas form full sized but seemingly immature peas. The result was that the following crop was loaded with pea plants as a weed!) The incorporated crop was heavy and lush and was broken down enough in under two weeks to direct seed a mid summer crop of leafy greens. The greens were fast growing and of good quality with no indication of any N deficiency. A subsequent fall planted rye seeding was also vigorous and showed no lack of N.

Field Peas and Rye: Winter rye is seeded in mid September, but thinly, leaving 6" to 8"between plants. Early in the spring I over seeded approx. 100# of field peas onto the rye seeding. I was able to incorporate the peas by running a rotovator over the field at a speed just barely slower than the ground speed of the rotating tines. Some of the rye pants were disturbed and killed, but most recovered and the peas were adequately covered. The mix then grew much like the Pea/Oat mix. The great advantage was that there was a standing, over-winter crop of rye to protect the soil from winter and spring erosion.

In Conclusion: I have been very encouraged by the results of these experimental green manure plantings and certainly plan to continue with these and other mixes. My goal was to try and grow, using various legume mixes, enough nitrogen to support healthy vegetable plant growth without adding any of the nutrients which have become excessive in some of our fields. For us it was a risky undertaking as it was not clear that the goals could be met. Not being able to harvest an adequate crop has always been a possibility and it has been very gratifying that for the most part subsequent crops have been of high quality and not lacking in nutrients including, especially, nitrogen. A significant added benefit has been that there has been a huge saving in the costs incurred in buying, hauling, composting, spreading and incorporating manures, composts and other fertilizing material. There are many aspects of these practices which I really need to better define. For instance: I need to more carefully record seeding rates and seeding times; I need to better organize before and after soil tests (several "after" have been sent in an will be available in time for the conference); and I need to more accurately monitor crop yields and biomass measurements. All in all, however, I am satisfied that I am headed in the right direction and doing something which will benefit our farm and hopefully other farms. Most importantly, perhaps, is that experimenting with these crops is interesting, rewarding and fun!