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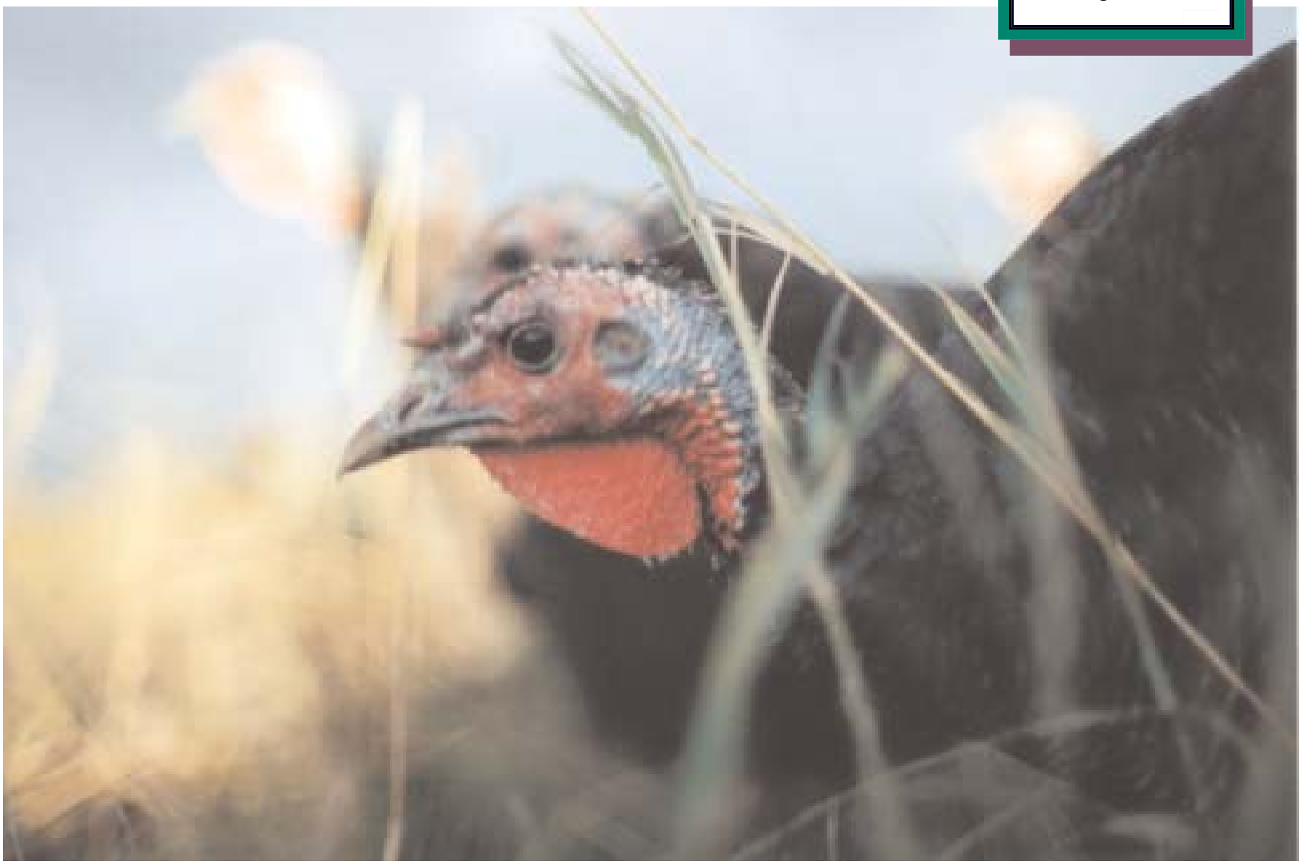

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Nutrient Management

by David Patriquin

Many believe that yields in organic farming are low because you cannot use fertilizers. Farmers making the transition to organic farming worry that they will not be able to provide enough nutrients for their crop, particularly nitrogen (N). That is not necessarily so! Apply proper organic nutrient management and overcome fertilizer withdrawal anxiety.

Organic farming seeks as much self-sufficiency of nutrients as it is possible to achieve in order to minimize negative impacts on the environment (and to cut production costs). However, nutrients can be imported when it is required.

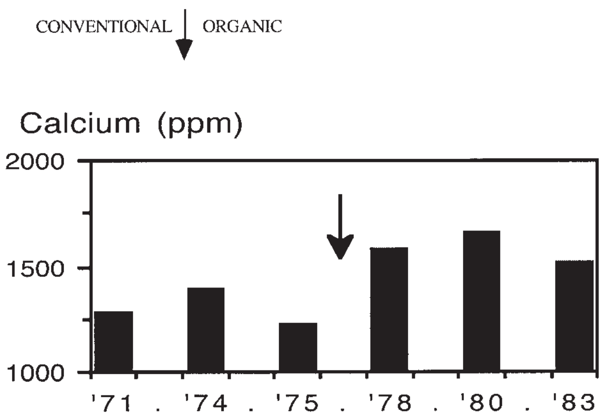
What it is very important is the form of those nutrients imported, which is established by certification codes. In general, only natural organic materials and minerals are permitted.

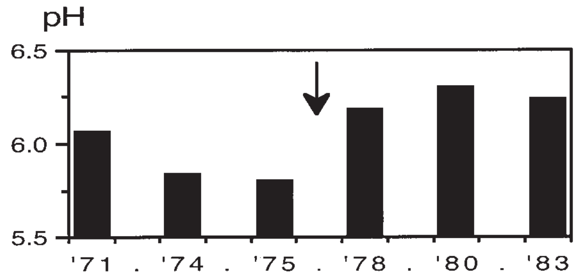
Generally, anything produced on an organic farm can be used with the restriction in most codes that fresh manure cannot be applied to food crops within six months of harvest.

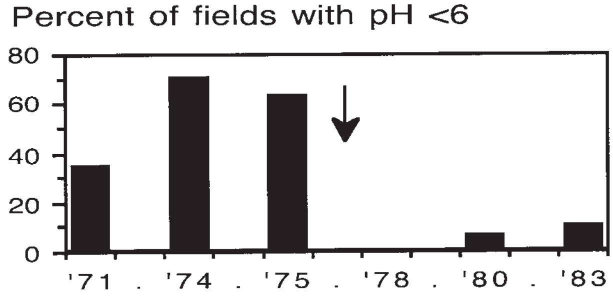
Nitrogen

In the initial stages of transition, there is often a shortage of N. This occurs because insufficient N is being brought into the farm as organic materials and by nitrogen fixation in legumes, and/or because the organic N that is already present is not mineralized (made available) when needed.

N is contained in a great variety of organic materials. So how do you know what type of N supplements to use and how much to apply? You can start by assuming that the amount required is the same as that required when using synthetic N, e.g., a crop may need 100 kg/ha of urea N. That number is then divided by an







A Benefit of Organic Management: Lower Lime Requirement

Farmers commonly report that lime requirement decreases after conversion to organic management.

These data obtained from Tunwath, a mixed farm in the Annapolis Valley which Basil and Lilian Aldhouse converted "cold turkey" to organic management in 1976, illustrate the point. Between 1964 and 1976, lime application averaged 915 kg per hectare per year. After conversion to organic management. calcium content and pH of the surface horizon (0-15 cm) increased , even though no further lime was applied. Apparently, some of the lime that had leached below the surface horizon during conventional management was brought back to the surface by earthworms and deep rooted crops and weeds; reduced leaching was also a factor.

By 1980, the system had reached a new equilibrium, and Ca and pH began to decline but more slowly than before; the new lime requirement was only 300-400 kg per hectare per year. Coarser grade limestone could then be used, allowing slower release and longer intervals between applications.

"availability factor" that indicates how much of the N in the organic source is available to the crop in one growing season. For example, if it is only 40% available, divide by 0.4 and the amount required is 250 kg/ha of the organic N.

The availability factor varies with percent N of the amendment. For most materials of 7% N and greater, the N availability in the first season is close to that of synthetic NPK (100%). For materials of 1 to 7% N, I have found that the availability factor can be estimated roughly by multiplying the % N by 12.5. (This applies to Nova Scotia).

This will do for the first shot at organic production. With time however, and in order not to overfertilize, you need to consider how much background (soil) N is available and how that changes over time as you use organic fertilizers, i.e. how much of the N in organic amendments is "carried over" to subsequent years. Determining the appropriate fudge factors for these calculations is partly a matter of using published numbers and partly a matter of doing simple tests to calibrate your own system. I have found that as a first approximation, you can estimate, the N available from an organic amendment in year 2 as 10 to 20% of that not released in year 1, and the N available in year 3 as 5 to 10% of N not released in years and 2.

For example, if we used a material of 3% N to provide 100 kg N/ha to a vegetable crop, the availability factor for Year 1 would be 3 x 12.5 or 37.5%. We would then apply 100 (0.03 x 0.375)= 8889 kg/ha of this material, containing a total of 267 kg N. 100 kg N are released the first year, leaving 167 kg; the carryover effect in the second year would then be 10-20% of 167 kg = 25 kg" N (assuming 15% availability); and in the third year it would be 11 kg (assuming 7.5% availability). N not released by the third year goes into the humus (stabilized soil organic matter).

In addition to N released from amendments, the inherent fertility related to soil organic matter levels should be considered. Roughly, under Nova Scotian conditions, 20 kg N/ha are released for each 1% of organic matter in the soil. A soil of 3% OM will provide 60 kg N/ha per season, and a soil of 5% OM, 100 kg N.

Such calculations can be used to estimate the approximate quantities of organic amendments required for good yields. However, each field, and crop will be a little different, and farmers are encouraged to experiment with N applications, e.g. by deleting amendments from a strip, and trying 25% more and 25% less than the normal rate on other strips. A simple method of checking how nutrient supply varies between fields is to grow ryegrass in pots containing soil from the different fields. One part of the test soil is mixed with one part of vermiculite and one part filler (Perlite), pots are seeded and the plants are allowed to grow for one month; they are then clipped and weighed. The comparison of dry weights provides an indication of difference in the inherent fertility of the soil between fields.

Fear of not having enough N leads to overcompensation and applying too much. Excess N may be indicated by foliage that is very dark green, excessive succulence, lodging, the size (large!) and species of weeds (lambs quarter), and in an

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abundance of pests such as aphids and fungal diseases.

N self-sufficiency is possible in the long term. This is particularly true for mixed farms where N can be obtained by growing legumes and grasses which the livestock converts in manure to be composted and applied to the crops.

On stockless farms this is more difficult to achieve, and even after many years, farmers tend to rely on some high N supplements (such as bloodmeal or fish fertilizer) for a quick turnover of N to the more demanding crops.

The minerals

It is not possible to be self sufficient in other macronutrients (P, K, Mg, C, S), and some will have to be imported. The amounts required can be greatly reduced through efficient recycling. Deep rooted cover crops can help recycle nutrients from depth in the soil. If N is managed properly, "nitrogen surges" which increase leaching losses of calcium, magnesium and potassium can be prevented.

In the longer term, potassium (K) shortages are often the most critical on organic farms. Potassium deficiencies make legumes "sluggish". Deficiencies can also increase pest and diseases.

Potassium is a problem because it leaches easily, and because there are few acceptable materials available that can be used. Potash (potassium chloride) is not allowed because of the toxicity of the chloride. A commonly used supplement is Langbeinite or "Sul-Po-Mag" (sometimes available locally only by special order). On mixed farms, the largest losses of K usually occur during manure handling; these can be greatly reduced by appropriate management.

Rock phosphate is often used to provide extra phosphorus (P), applying it to barn gutters to or to compost heaps to catch ammonia and activate the P. Although rock phosphate is a natural mineral, it can be problematical because of high levels of heavy metals in some rock-P (which is not stated). With the use of organic fertilizers, the P found in the soil becomes more available. Phosphorus should not be a limitation to organic production in operations importing organic amendments to provide N. In fact there is more danger of an excess of P accumulating because organic materials such as manure and fish wastes have an excess of P compared to N compared to plant needs, and soil losses are minimal.

Residues, tillage and crop rotation

The methods used to incorporate residues, cultivate weeds and prepare seedbeds have important effects on aeration, drainage, and modes and rates of decomposition not only in the current year but for at least the following year as well; these processes in turn affect nutrient availability, pests, diseases and weeds.

The single most important factor in developing a system that functions effectively and efficiently over the short and long term is the institution of a regular rotation of crops and associated practices.

Diagnosis

With organic management, soil nutrient pools change more slowly than they do under conventional management, and soil analyses are needed only every 3-5 years. In soils, large amounts of P may be retained in the soil organic matter. Soil tests that measure the inorganic P fraction do not necessarily indicate the P reserve in organic matter, which is made slowly available through mineralization. Similarly, soil tests may not measure slowly available potassium. To diagnose deficiencies in nutrients, I strongly recommend leaf tissue analyses over soil analyses.

modified from an article in The Organic Times. ✓