

Potential of Management Practices and Amendments to Prevent Nutrient Deficiencies under Organic Cropping

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Soil Fertility in Organic Systems

- Synthetic fertilizers cannot be applied under organic production to correct or prevent nutrient deficiencies or to increase crop yield.
- As a result, soil fertility is a top research priority for sustainable organic crop production.
- Any nutrient that is limiting/not in balance can substantially reduce crop yield and quality; nutrient use efficiency (NUE); water use efficiency (WUE); and soil quality.
- These impacts may increase nitrate leaching and greenhouse gas (GHG) emissions.
- Typically, organically farmed soils in the prairies are deficient in available nitrogen (N), many are low in phosphorous (P), and some contain insufficient sulfur (S) and potassium (K) for optimum crop yield.
- Maintaining adequate P is especially of concern as most prairie soils have low available P.
- Most P that is present in the soil may not be available for plant growth due to low solubility and there are few available organic P amendments.

Nutrient Management Strategies: Fix, Return, Supply, Recycle

Sustainability of crop production under organic farming can be increased by using effective nutrient management strategies.

Amendments:

- Composted livestock manure adds N, P and other nutrients may have greater potential in restoring soil P than other strategies.
- Alfalfa pellets supply N, P and other nutrients.
- Wood ash can be effective in supplying P and/or S, has liming effect, and contains K, calcium (Ca) and micronutrients.
- Granular-rock phosphate (RP), alone or in combination with fungal inoculants did not provide any yield benefit in recent trials.
- Fine powder-RP, however, provided some yield improvement in one trial year.

- Gypsum effectively prevents/corrects S deficiency.
- A new rapid release elemental S (RRES) granular is being tested for its feasibility as S amendment for organic producers.
- Thin stillage (ethanol by-product) was found very effective in increasing crop yield.
- Distillers grain and fish food additives have been shown to improve crop yield, most noticeable after 3 annual applications.
- Microbial inoculants like Jumpstart (*Penicillium bilaiiae*) and MykePro can only increase P availability from existing soil reserves.
- In other words, they do not increase the amount of total P in soil unlike legume (Rhizobium) inoculants which add N to the soil].
- In our trial results, their beneficial effects on crop yield have been small and inconsistent.
- Other amendments – alfalfa-canola meal pellets, glycerol (biodiesel by products)

Cultural practices:

- Legumes grown for seed/forage or as green manure help to replace N.
- Summer fallow helps replace N and some other nutrients.
- However there is risk of erosion and deterioration of soil quality.
- Intercropping of cereals or oilseeds with pea to provide substantial yield benefits and increasing net returns.
- Alternating deep taproot with shallow fibrous root crops in rotation captures nutrients at different depths that could be otherwise lost.
- Returning crop residues improves soil quality characteristics, supplies organic matter, and returns some N, P, K, S and micronutrients back to the soil.
- Growing certain crop species/cultivars which perform well on low P soils to reduce/minimize the impact of P deficiency on crop yield.

Recommendations

Integrate management practices and organic amendments to:

- (1) Increase sustainability of organic crop production
- (2) Improve soil quality
- (3) Minimize environmental damage (e.g., nitrate leaching and GHG emissions)

When considering adopting a new amendment or practice, apply in a limited way initially (e.g., as a test strip) to determine if there is an economic benefit (e.g., seed yield increase; optimize efficiency).

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