

Soil Fertility Considerations

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Recently I attended soil fertility training sessions and spent some time reviewing Cornell University's new corn and soybean N-P rate (nitrogen & phosphorous) studies. Here are some soil fertility tidbits taken from this

1. **N Rates for Barley & Spring Wheat** – Doug MacDonald of CDI-NSAC reported on a 3 year nitrogen study done on 7 different barley varieties. The low nitrogen rate in this study of 50 kg/ha N produced as much yield (4.3 t/ha) as the 100 & 150 kg/ha rates. Perhaps the 70 kg/ha N rate that we've traditionally recommended in this province is higher than it needs to be particularly on soils with more than 3.5% organic matter (O.M.) or fields that also get manure every 2-3 years.

For **spring wheat** there was not an economic response when increasing from 50 to 100 kg/ha N, however yields in this study were low (3.1 & 3.3 t/ha respectively). When targeting spring wheat yields of 4-5 t/ha we likely need 75-90 N (which include all nitrogen sources, not just fertilizer).

2. **N Rates for Winter Wheat** – The CDI-NSAC agronomy research team also has 4 years of N rate work on AC Grandview, Freedom and AC Sampson and 3 years of data on Pioneer 25R23 & 25R47. All five of these winter wheat varieties reacted similarly in that the best nitrogen response was at 85 versus 135 kg/ha N rates. These results support our total springtime N recommendations of 85-100 N (split over 2 spring applications) when going for 5-6 t/ha yield target.
3. **N-P-K Rates for Timothy** – Bill Thomas did a joint study with the AZAR research group from 2000-2004 on 5 central NS farms to look at fertilizer strategies on grass forage. The trial fields were medium to high in P-K fertility (soil test was 190-400 kg/ha P₂O₅ and 150-500 kg/ha K₂O). Regardless of these P-K soil test levels, Bill thought the most economic 1st cut yields came from fertilizer rates of 70-80 N, 30 P and 60-80 K when no manure was applied. The best 2nd cut yields came from 50-60 N & no P-K, in years when there was enough soil moisture for a 2nd cut timothy harvest. Please note that the 30 P and 60-80 K applied to 1st cut grasses replenishes what a 5-6 t/ha 1st cut grass crop will remove from the soil. For soil tests under 250 kg/ha of P₂O₅ (phosphorous) or 300 kg/ha of K₂O (potassium) there should be higher amounts on P-K applied through fertilizer or manure during the year to help build soil P-K.
4. **No starter N&P for Soybeans** – Dr. Claude Caldwell the cereal, soybean & oilseed crop professor at NSAC, has been telling us for years that we shouldn't use any nitrogen on soybeans with properly inoculated seed. A recent 3-year Cornell University study at their research farm supports this strategy. The Cornell study looked at both fields with a recent history of soybean production and fields that have never grown soybeans. These test fields were high to very high for soil phosphorous levels. The treatments were (a) inoculum only, both Cell-Tech or Hi-Stick were tested (b) starter fertilizer only at rates of

17 kg/ha N and 60 kg/ha P₂O₅ (c) inoculum plus starter fertilizer and (d) no inoculum – no starter fertilizer combo. Based on the yield results from this study Cornell recommends the use of inoculum for all soybean plantings, even in fields with a frequent soybean history. Also, they do not recommend starter P for soybeans in fields that test high in P (equivalent to over 300 kg/ha P₂O₅ in our NSDA lab analysis). Cornell also says not to use N fertilizer, even on fields without any soybean history.

5. **N&P Rates for Corn** – Cornell U. has also done lots of N&P rate work on corn in the last 5 years (27 on-farm demo trials). Although NY State has higher heat units than us and warmer early spring soils (which will improve P availability) the corn silage yields they reported in this study are in-line with our better N.S. yields at 17-18 tonnes/acre at 35% D.M. The Cornell results showed that on fields testing high in P and not receiving manure, the P starter levels could be reduced to 28 kg/ha P₂O₅ or less. On sites that test very high in P or high P sites that receive manure a P-free starter could be used without yield or silage quality penalty.

Regarding N, Cornell is saying that for 1st year corn with a 20% or more legume plow down and/or a manure application of at least 25 t/ha, that the only additional nitrogen needed is 33 kg/ha N in the starter band. On 2nd year corn (out of alfalfa) only 5 of 12 sites showed a significant yield response to the 33 kg/ha N starter plus 100-120 kg/ha N top dressed, the other 7 sites had the best yields with starter N only (however no mention was made if manure was used on some of these 7 sites).

In Ontario, OMAFRA staff have just produced “The Ontario Corn N Worksheet” where the historic yields for a particular field is multiplied by 13.6 kg N needed per tonne of grain yield (or 0.77 lb N per bushel). This converts to 100 N for a dry corn yield of 7.5 tonnes/ha (or 120 bu/ac= 3mt/ac). The 0.77 lb N/bu. is considerably less than 10-20 years ago when most North American corn experts were suggesting 1.0-1.2 lb N/bushel of corn yield.

What do we recommend for our corn crops? For starter P on high P soils (275-400 kg/ha P₂O₅) we like to see 15-25 P in the band regardless of the manure treatment. For soils very high in P (>400 kg/ha P₂O₅) apply 10-15 P in the band with a 30-10-0AN starter. For soils lower in P (<275 kg/ha P₂O₅) more P should be applied in the band by using appropriate amounts of a 25-25-0AN, 17-17-17 or 18-46-0 starter, depending on actual soil test P levels and manure P application rates.

For N rates, I'd suggest for fields that can realistically produce target yields of 3-4 mt/acre grain corn @ 22-28% moisture or silage crops of 16-18 mt/acre @ 35% D.M. consider using 120-150 N from all contributing sources. For fields with lower yield potential then mentioned above, use between 90-115 N.

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