Use Blends of N Fertilizers for Higher Economic Returns!

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Other than anhydrous ammonia, urea is the cheapest source of N. It is readily available and easy to handle/and transport. However, urea is quickly hydrolyzed and converted into nitrate form in the soil. As a result, there is often more available N in the soil than the crop plants will need at the initial stages. It may also be noted that the soils are seldom devoid of any residual N/or retentive N. Nitrate N can be lost into air (as volatilization and denitrification) or water (as leaching) under adverse weather conditions. Thus there may not be enough N left in the soil in the later stages of crops growth, especially at grain formation/maturity in cereals that could impact grain yield/or protein content. Treatment of urea with nitrification inhibitors such as Agrotain has not worked well under our agro-climatic conditions. I therefore tried using other slow release N fertilizers (ESN and ammonium sulphate) as a part or full substitute of urea for crop production at Thunder Bay.

ESN, Environmentally Smart Nitrogen, a brand name of polymer coated urea, by Agrium Inc. Calgary, Alberta, is considered costlier than urea. Polymer coated urea capsules have micro pores through which water enters, dissolves urea and then slowly releases it through the pores. The release process and speed is governed by the soil moisture and temperature. It could take up to 60 days for complete dissolution of urea from the ESN in the soil. It may therefore make sense to apply part of the total N as urea to ensure proper early crop growth. On per kg N basis, ESN is 20-25 % costlier than urea. Likewise, N from ammonium sulphate (in slow release ammoniacal form) is costlier than that from urea. However, if 24 % sulphur (S) supply is taken into account, ammonium sulphate isn't really costlier than urea, especially for soils low in available S or for crops responsive to S e.g. canola and alfalfa. Moreover higher cost of N from ESN and ammonium sulphate than that from urea should be viewed in terms of returns per dollar investment in N from these fertilizers. A few examples, given below, from research at TBARS, will prove that the use of ESN and ammonium sulphate is economically rewarding.

At the same rate of N (70 kg/ha), barley grain yield was 362 kg/ha higher with ESN than that with urea at an extra cost of $21/ha. Even @ $150/MT barley, value of extra yield with ESN would be $54.3/ha i.e. a net gain of $33.3/ha. When only part of N (20 kg N/ha) from urea was replaced with ESN, the grain yield gain as compared to urea alone was 816 kg/ha (= $122.4 @150/MT grain) at an extra cost of only $6/ha; i.e. a net gain of $116.4/ha.

In silage barley, dry matter yield was 981 kg/ha higher when only 10 kg N/ha from urea was replaced with that from ammonium sulphate. This works out to extra returns of $88.3/ha (@ $90/ MT barley dry matter) with an extra cost of $9.8/ha only. This translates to a net gain of $78.5/ ha. Dry matter yield gain by using a blend of urea (40 kg N/ha), ESN (20 kg N/ha) and ammonium sulphate (10 kg N/ha) as compared to urea alone @ 70 kg N/ha was 1134 kg/ha (= $102.6/ha) at an extra cost of $15.25/ha. Net gain from this practice comes to $87.35/ha. Thus the net gain from using a blend of three N fertilizers (urea, ESN and ammonium sulphate) was

even higher than using a blend of only two fertilizers (urea and ammonium sulphate); when compared with only urea as a N source.

In another experiment on forage grasses mixture (50 % timothy, 42.5 % bromegrass and 7.5 % orchardgrass), it was found that N application @ 140 kg/ha gave significantly higher dry matter yield than 105 kg N/ha; usually recommended for grass production. Dry matter yield gain by using a blend of three N fertilizers (urea @ 84.5 kg N/ha + ESN @ 35 kg N/ha + ammonium sulphate @ 20.5 kg N/ha; total 140 kg N/ha) as compared to urea alone @ 140 kg/ha was 908 kg/ha (= $ 81.7/ha @ $90/MT hay) with an extra fertilizer cost of $ 29.6/ha. The net gain of using a blend of three N fertilizers as compared to urea alone was $52.1/ha. Over a large acreage, the net gain from the use of N fertilizer blends will be many folds.

Past research at TBARS has shown some other advantages of using ESN. Entire amount of N from ESN could be applied (i) in the seed row in winter/or spring wheat without any damage to seedlings/crops, (ii) in the fall to forage grasses with advantage of ease/or reduced field operations (same yield as compared to urea applied in two splits; in early spring and after the first cut, and (iii) up to 2 % higher protein content in forage grasses. Monetary value of this added protein could be much more than the extra N cost from ESN. Residual N from the application of ESN was mostly in ammoniacal N (that could be retained on clay and organic matter in the soil), whereas most of the residual N from applied urea was in the form of nitrate N (subject to losses). Unlike urea N, significant residual effect of N applied as ESN/and ammonium sulphate in previous years was recorded in higher forage grasses dry matter production in the subsequent year(s). I believe that using blends of N fertilizers is a good option to minimize impacts of changing/unpredictable weather conditions. Enlightened growers of northwestern Ontario may therefore adopt this practice for higher economic returns from crop production.

Note: Price of 1 kg N from urea, ESN and Ammonium sulphate was taken as $ 1.22, $ 1.49 & $ 2.2, respectively, without discounting the S supplied by ammonium sulphate.

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