# 8. UREASE INHIBITOR AGROTAIN: SURFACE APPLIED UREA FOR FESCUE

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## INTRODUCTION

The earliest means of applying commercial fertilizer for grass seed crops consisted of applying the fertilizer on the soil surface. This technique was later found to result in the inefficient use of the fertilizer applied and with the development of new equipment came new methods for applying fertilizer. Surface application resulted in an opportunity for N fertilizer both to be lost into the atmosphere and it also presented an opportunity for weeds to access the fertilizer before the crop could.

Producers who wish to apply N fertilizer to their grass seed and hay crops have had several choices:

1. ammonium nitrate (34-0-0).
2. urea (46-0-0).
3. urea/ammonium nitrate solution (28-0-0).

As 28-0-0 liquid solution is not a commonly used N source for fertilizing grass seed crops in the Peace region our discussion will be limited to the use of ammonium nitrate and urea.

The advantages of urea can be described as:

1. concentration, it is 46% pure nitrogen, the most pure form of nitrogen next to anhydrous ammonia (82-0-0). This means fewer trips to the elevator for product and a longer time between filling.
2. price, it is usually less expensive than ammonium nitrate.

In contrast to the known benefits there are also some disadvantages of using urea to consider, including:

1. volatilization (conversion of surface applied/broadcast urea into the gaseous form ammonia and lost into atmosphere) losses can be higher. These losses can be greatest when air temperatures are above 10 degrees Celsius or when soil temperatures are above five degrees Celsius.

The advantages of ammonium nitrate have been noted as:

1. not susceptible to volatilization. The nitrogen contained is half in the form of nitrate and half in the form of ammonium

In contrast to the known benefits there are also some disadvantages of using ammonium nitrate to consider, including:

1. lower purity than urea, greater volume must be used to achieve same N application rate of urea.
2. more expensive than urea.
3. the product is no longer available! Production in Canada ended in July 2005 and was only available until existing supplies ran out.

## HOW TO SOLVE UREA LOSSES

The simplest solution to avoid volatilization losses of urea is to make sure that the amount of urea that can be exposed to the urease enzyme is limited.

Polymer-coated urea (an example being Agrium's ESN polymer coated urea product, 44-0-0) is a new urea product to address this concern. By applying a thin polymer coating to the fertilizer prills, water can be absorbed by the prill and the urea dissolved. This product limits the amount of urea that can be released through the polymer coating ensuring that nitrogen is released in a slower, steady volume thoughout the growing season to better meet the plants needs.

The benefit from applying the fertilizer at different times of the year does vary with crop type. For example, Westco maintained 4 bromegrass trials in south-central Alberta over a 15-year period where broadcast applications of 46-0-0 and 34-0-0 to give 100 lb/ac of N were compared over four different applications dates (early and fall, early and late spring). The highest yield was achieved by 34-0-0 applied in the early spring. Averaged across all application dates, 46-0-0 was only able to achieve 80% of the yield that 34-0-0 did.

## Urease Inhibitor

An alternative strategy to applying a coating to 46-0-0 is instead to prevent the urease enzyme from coming into contact with the urea. Urease inhibitors such as Agrotain are applied to urea fertilizer prior to being broadcast on the field. Depending on the rate used, Agrotain can prevent the conversion of urea to ammonia by as long as 14 days. This gives a window of opportunity for favorable environmental conditions like rainfall to occur and move the urea into the soil where the

activities of the urease enzyme are not as problematic.

## Environmental and Soil Factors

The environmental conditions after the fertilizer has been applied that can have an impact upon the level of fertilizer he can apply and the potential for N losses are:

1. % clay content of soil.
2. Level of soil moisture.
3. Level of soil organic matter.
4. Wind speed.
5. Soil temperature.
6. Air temperature.

Clay content will have an influence on the ability of the soil to tie up ammonia that is released from urea (46-0-0) fertilizer. The ammonia will form a bond with any available water molecules and as clay will retain water to a greater degree than will sandy or silty soils a higher clay content soil can aid seed/seedlings in withstanding higher levels of N fertilizer in close proximity.

Soil moisture levels play a role in determining the safe levels of seed-applied urea fertilizer, as each molecule of water available may bind with the ammonia that is formed from urea.

Soil organic matter levels have a similar impact as organic matter is able to retain 10 times its weight in water.

This information is summarized in Table 8.1 below.

**Table 8.1 Impact of Environmental Factors**

| Low N Loss | High N Loss |
|---|---|
| **Environmental Factors** | |
| Dry soil surface | Moist soil surface |
| Cold soils | Warm soils |
| No wind | Windy conditions |
| Greater than 0.5” rain within 1-3 days of broadcasting | Less than 0.5" of precipitation occurs more than 3-5 days after broadcasting |
| **Soil Factors** | |
| Fine textured soils (clay) | Coarse textures soils (sand) |
| High soil organic matter content | Low soil organic matter content |
| Few plant residues on soil surface | Abundant plant residues on soil |

## OBJECTIVES

The objective of this test was to compare the differences between applying urea fertilizer with and without a urease inhibitor for surface applied urea in fescue seed production.

## METHODS

**CPCS wish to extend our thanks to the Agricultural Opportunity Fund (AOF) and the Peace Region Forage Seed Association for funding this project.**

A field scale, replicated trial was set up at SW 27 81 9 W6, just east of Savanna. **CPCS would like to recognize and thank Barry and Donna Nelson for their generous support of our research program by providing this site for our use.**

A complete block plot design with four replicates was used. There were 2 treatments compared:

1. Urea with Agrotain.
2. Urea without Agrotain.

The plot was fertilized on November 3rd 2005. Environmental conditions on this day were a temperature of plus 5 celsius with no wind and no snow had yet fallen (ground was bare). On November 6th 2005 there was frost and 2 to 4 cm of snow.

The urea without Agrotain fertilizer treatment was applied at a rate of 76 lb of N/ac (165 lb of urea/ac). The urea with Agrotain fertilizer treatment had a slightly lower application rate of 69 lb of N/ac (150 lb/ac of urea/ac) due to the wetness of the urea after it was mixed with the Agrotain (even though the fertilizer spreader settings were identical). The Agrotain was applied at a rate of 3.94 l/t of urea, this works out to a cost of $0.03 per lb of urea ($0.065/lb of N).

Observations made on during the summer found that there were no visible differences between the treatments.

The center strip of each plot was swathed on September 24th and combined on July 22nd. The strips were weighed with a weigh wagon and samples were retained to determine % dockage, % moisture and grade. The results are given in Table 8.7 and Figure 8.1.

**TABLE 8.7 Effect of Agrotain On Urea On Fescue Seed Production, Nelson Site, 2006**

| Fertilizer Treatment | Yield lb/ac* | % Moisture* | % Dockage* | Treatment Cost $/ac* | Contribution Margin $/ac |
|---|---|---|---|---|---|
| Urea Without Agrotain | 566.5a | 11.2a | 13.8a | 33.66 | 192.94 |
| Urea With Agrotain | 580.0a | 11.1a | 15.0 b | 35.25 | 196.75 |
| | | | | | |
| P | 0.33 | 0.39 | 0.01 | | |
| CV | 2.8% | 0.3% | 2.5% | | |

*means followed by the same letter are not statistically different at P=0.05.
#1 Common Fescue @ $0.40/lb, 46-0-0 @ $0.204/lb of urea, Agrotain @ $0.031/lb of urea treated

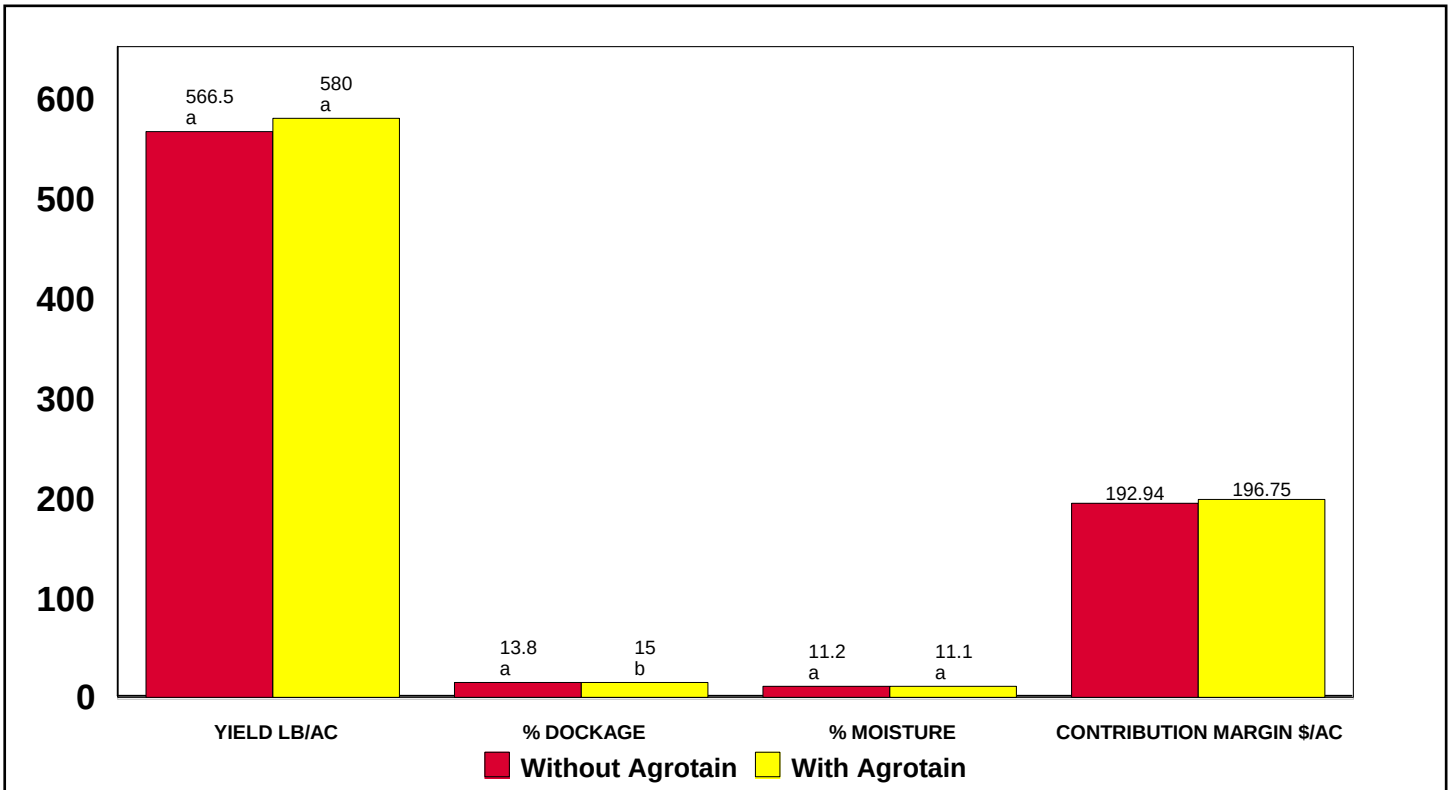


**FIGURE 8.1 IMPACT OF AGROTAIN ON BROADCAST UREA ON FESCUE SEED PRODUCTION, NELSON SITE, 2006**

## RESULTS and DISCUSSION

### 2006 Trial

At the Nelson site in 2006 there were significant differences between the Agrotain treatments in terms of % dockage (P=0.02) with the Agrotain treatment having a higher % dockage than the non-Agrotain treatment.

At the Nelson site in 2006 there were no significant differences between the Agrotain treatments in terms of yield (P=0.33) and % moisture (P=0.39).

The premise of the benefit of Agrotain would not likely have been identified in this study. If we remember from the beginning of this chapter, Agrotain would be of greatest benefit to broadcast urea applications when the air and soil temperature are 10 and 5 degrees Celsius respectively, it is windy and the soil surface is warm. By contrast, when the urea was broadcast, it was very cool and snow/frost followed after several days. This would have tended to dissolve and move the urea into the soil where it would not have been subject to volatilization.

The Urea With Agrotain treatment generated a higher contribution margin of $3.81 per acre. However, the application rate of the Urea with Agrotain treatment was also 15 lb/ac lower than the Urea without Agrotain treatment. Had the rates been identical then the treatment cost for the Urea

with Agrotain would have been $38.78/ac instead of $35.25/ac and thus the contribution margin would have been $193.22 instead of $196.75. The difference in contribution margins between the treatments would then only be $0.22/ac rather than $3.81/ac. It is unlikely that the additional 7 lb/ac of N would have increased the Urea with Agrotain yield higher than 580/ac.

## CONCLUSIONS

### 2006 Trial

We found that there was only a small economic benefit from using Agrotain at this site. Given that the application conditions would have been least favorable to generating volatilization losses from the broadcast urea, it would appear that there is little benefit to be had from using this product. Similar results should be expected from a very early spring application.

Producers should still be cautious that using urea earlier in the fall or in the spring when the environmental conditions would favor volatilization occurring and thus the use of Agrotain could be warranted.

## REFERENCES

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