Use of Calcium Ammonium Nitrate for Fertilizing Smooth Bromegrass and Timothy Seed Stands

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Background

Ammonium nitrate fertilizer (34-0-0) is no longer readily available to producers in western Canada. As a result, grass seed producers are left with a need to identify how to manage the nitrogen requirements of these crops. Ammonium nitrate was an excellent product for broadcasting onto forage crops as it provided a low risk to producers in terms of losses of nitrogen by volatilization. In order to manage risk producers paid a premium for ammonium nitrate. There are, however, several alternatives that, depending on management, can be as reliable as ammonium nitrate from an agronomic point of view.

Calcium ammonium nitrate (CAN) is a mixture of ammonium nitrate and calcium-magnesium carbonate (27% nitrogen, 4% calcium and 1% magnesium). This product, similar to ammonium nitrate, is available in a pelletized form in 25 kg bags and is distributed by YARA Canada. The cost per pound of actual nitrogen of calcium ammonium nitrate is close to double the cost of urea.

Agrotain is a urease inhibitor that is applied to granular urea or liquid urea-ammonium nitrate (UAN) fertilizer products reduces the risk of volatilization when surface broadcasted on crops such as forages. Agrotain can minimize the risk of losses due to volatilization for a period of 7-14 days following application depending on rate. The cost of Agrotain is approximately $.05-.09/lb of nitrogen.

Environmentally Smart Nitrogen (ESN) is a polymer coated urea that provides excellent protection against volatile losses of nitrogen. The nitrogen is released very slowly and may not meet the nitrogen requirements of the grass crop early enough to give similar yield responses as untreated urea or ammonium nitrate. The cost of ESN is approximately $0.10/lb of treated urea.

Objectives

A one year study was conducted to compare the effects of calcium ammonium nitrate with several different sources of nitrogen fertilizer. The different forms of nitrogen fertilizer were applied in the fall and spring to timothy and smooth bromegrass seed crops. Sources of nitrogen include calcium ammonium nitrate, urea, ammonium nitrate, ESN and urea+Agrotain.

Methods

Three **t**rials were initiated on grass seed stands in the fall of 2009. Soil nutrient test were taken prior to fall fertilizing (Table 1). One rate of nitrogen was used at each site with nitrogen applied in several different forms. Agrotain was applied to urea at 5.2 l/tonne. Applications of nitrogen were made in late fall and early spring. Nitrogen fertilizer was applied to each plot using a small plot Hege 33 fertilizer spreader. Plot size was 1.5 x 7.5 m long. Experimental design was a randomized complete block design with four replicates. Plots were harvested by making two passes with a Japanese Rice binder down the length of each plot. Material was placed in bags and dried. The samples were weighed prior to thrashing to determine dry matter yields. Seed samples were cleaned and weighed. 1000 kwts were also conducted on the seed samples.

Table 1. Soil test results from sites.

	Nutrients (ppm)					pH	OM%
	Depth	**N**	**P**	**K**	**S**		
Smooth brome – Manning	0-6'	3	16	379	17	6.5	
	6-12'	3			21	6.4	
Smooth brome – Beaverlodge	0-6'	<2	35	190	8	5.9	6.7
Timothy – Beaverlodge	0-6'	<2	29	196	6	6.2	8.6

Smooth Bromegrass Manning: This trial was conducted on a three year old smooth bromegrass seed stand located on the NPARA farm south of Manning. Urea, calcium ammonium nitrate and ammonium nitrate were applied in the fall and spring. ESN was applied in the fall only. Actual nitrogen was applied at a rate of 78 kg/ha (70 lbs/acre). Fertilizer applications were broadcast on top of 4 inches of snow on November 4th, 2009. Spring applications were made on dry, unfrozen ground, on April 20th, 2010. All plots were harvested on August 3rd , 2010 from an area of 5.4 m2.

Smooth Bromegrass Beaverlodge: This trial was conducted on a 2 year old stand of smooth bromegrass. Urea, calcium ammonium nitrate and urea+Agrotain were broadcast in the fall and spring. Actual nitrogen was applied at a rate of 90 kg/ha (80 lbs/acre) on October 22nd , 2009 and April 23rd 2010. All plots were harvested on August 10th , 2010 from an area of 6.3 m2.

Timothy Beaverlodge: This trial was conducted on a 2 year old stand of timothy. Urea, calcium ammonium nitrate and urea+Agrotain were broadcast in the fall and spring. Nitrogen was applied at a rate of 90 kg/ha (80 lbs/acre) on October 22nd , 2009 and April 23rd 2010. All plots were harvested on August 9th , 2010 from an area of 6.3 m2.

Results

Smooth bromegrass Manning

The first significant levels of precipitation received in the spring at this site was 18.2 mm which was twenty-eight days following the spring application of fertilizers (Appendix A). This certainly reduced the effectiveness of all the spring applied fertilizers particularly urea and urea+Agrotain. Smooth bromegrass forage and seed yields were affected by the weather conditions and the dry matter and seed yield values were extremely variable at the Manning location (Table 2). Smooth bromegrass forage yields from fall applied ESN were significantly lower than that of fall applied calcium ammonium nitrate. Although there was not significant differences in the forage yield values, smooth bromegrass forage yields were lower under fall application of ESN than any of the other sources of nitrogen applied in fall or spring.

Smooth bromegrass seed yields doubled when fertilizer was applied in the fall as compared to spring applications. This was mainly attributed to a lack of precipitation following the spring applications. Seed yields following the fall application of urea, calcium ammonium nitrate and ammonium nitrate were significantly higher than fall application of ESN. There was no significant differences in 1000 kwt values among any of the treatments.

Table 2. Effects of forms of nitrogen (68 kg/ha) applied spring and fall on smooth bromegrass seed and forage yields, Manning 2009/10.

TREATMENT	**TIMING**	**D.M.YIELD kg/ha**	**SEED YIELD kg/ha**	**1000 KWT G**
Urea	Fall	4843 ab	532 a	3.392 a
Calcium ammonium nitrate	Fall	4963 a	518 a	3.671 a
Ammonium nitrate	Fall	4590 ab	462 a	3.566 a
ESN	Fall	3590 b	258 b	3.453 a
Urea	Spring	4267 ab	138 b	3.411 a
Calcium ammonium nitrate	Spring	4682 ab	192 b	3.625 a
Ammonium nitrate	Spring	4636 ab	139 b	3.721 a
LSD (P=.05)		1190	173	NSD
CV%		17.8	37.0	8.49

Means followed by the same letter do not significantly differ (P=.05, Duncan's New MRT)

Smooth bromegrass-Beaverlodge

One week following fertilizer applications made in the fall the site received 19 mm of rainfall. The first significant precipitation in the spring was 30 mm of rainfall twenty-seven days following the spring fertilizer applications (Appendix A). Forage yield values of smooth bromegrass were slightly higher when nitrogen was applied in the fall as compared to the spring application (Table 3). Smooth bromegrass seed yields were substantially higher when nitrogen was applied in the fall as compared to the spring applications.

There were no significant differences in forage or seed yields among the different sources of nitrogen applied in the fall. When nitrogen was applied in the spring both forage and seed yields from calcium ammonium-nitrate were higher than urea or urea+Agrotain.

Table 3. Effects of forms of nitrogen (90 kg/ha) applied spring and fall on smooth bromegrass seed and forage yields, Beaverlodge 2009/10.

TREATMENT	**TIMING**	**D.M.YIELD kg/ha**	**SEED YIELD kg/ha**	**1000 KWT g**
Urea	Fall	8927 a	722 a	3.799 ab
Calcium ammonium nitrate	Fall	8946 a	803 a	3.702 b
Urea+Agrotain	Fall	8927 a	780 a	3.907 ab
Urea	Spring	7419 b	279 c	3.976 ab
Calcium ammonium nitrate	Spring	9085 a	461 b	3.824 ab
Urea+Agrotain	Spring	8135 ab	238 c	4.026 a
LSD (P=.05)		1020	115	0.263
CV%		7.9	13.8	4.5

Means followed by the same letter do not significantly differ (P=.05, Duncan's New MRT)

Timothy-Beaverlodge
One week following fertilizer applications made in the fall the site received 19 mm of rainfall. The first significant precipitation in the spring was 30 mm of rainfall twenty-six days following the spring fertilizer applications. There were no significant differences in timothy forage yields among the different sources of nitrogen or the timing of application (Table 4). Seed yields following the spring application of nitrogen fertilizer were higher than the fall applications. Seed yields following the fall application of urea were higher than both fall applied calcium ammonium nitrate and urea+Agrotain. There were no significant differences among the forms of nitrogen when applied in the spring.

Table 4. Effects of forms of nitrogen (90 kg/ha) applied spring and fall on timothy seed and forage yields, Beaverlodge 2009/10.

TREATMENT	**TIMING**	**D.M.YIELD kg/ha**	**SEED YIELD kg/ha**
Urea	Fall	4861 a	449 a
Calcium ammonium nitrate	Fall	5020 a	353 b
Urea+Agrotain	Fall	4802 a	348 b
Urea	Spring	5119 a	512 a
Calcium ammonium nitrate	Spring	5318 a	474 a
Urea+Agrotain	Spring	5179 a	495 a
LSD (P=.05)		494	76.1
CV%		6.5	11.5

Means followed by the same letter do not significantly differ (P=.05, Duncan's New MRT)

<u>Summary</u>

- Smooth bromegrass seed yields were two to three times higher under the fall application of nitrogen than under the spring applications at both locations. This was mainly due to the sites receiving very little precipitation for several weeks following the spring fertilizer applications.
- Timothy seed yields were higher when nitrogen was applied in the spring as compared with that of fall applications.
- Urea alone was as effective as any of the other source of nitrogen when applied in the fall.
- Smooth bromegrass seed yields from fall applied ESN were 50% lower than fall applied urea or calcium ammonium-nitrate.
- When nitrogen was applied in the spring, smooth bromegrass seed yields were higher following the application of calcium ammonium nitrate as compared to either urea or urea+Agrotain. This was likely due to the losses of nitrogen by volatilization of urea since it was several weeks before precipitation was received following the spring fertilizer applications.
- There was no timothy forage or seed yield benefit to using calcium ammonium nitrate or urea+Agrotain on timothy as compared to urea alone when applied in either the spring or fall.

APPENDIX A

Table 1. Precipitation (mm) received over a 31 day period following the broadcast application of fertilizer applied at Beaverlodge and Manning.

Days Following Applications	Beaverlodge		Manning	
	Oct. 22, 2009	April 23, 2010	Nov. 4th, 2009	April 20th, 2010
1	0.8	0.0	0	0
2	0.2	0.0	0	0
3	0.0	0.0	0	0
4	2.0	2.2	0	0.1
5	0.2	2.0	0	0
6	0.0	0.0	0	0
7	9.1	0.0	0	0
8	10.0	0.0	0	2.1
9	0.0	0.0	0	0
10	0.0	0.0	0	0.1
11	0.0	0.6	0	0
12	0.4	0.6	1.5	0
13	0.0	0.0	2.8	1.4
14	0.0	0.0	0.1	0.2
15	0.0	0.0	0.2	0
16	0.0	0.2	0.1	0
17	0.0	0.0	0	0
18	0.0	0.0	0.1	0
19	0.0	0.0	3.1	0
20	0.0	0.0	0	0
21	0.0	0.0	0.1	0
22	0.0	0.0	0	0
23	19.3	0.0	0	0
24	14.1	0.2	0	0
25	4.4	6.6	0	0
26	0.0	2.8	0	0
27	0.0	30.0		0
28	0.0	19.4		18.2
29	0.0	0.8		6.8
30	0.7	0.0		0
31	0.0	0.2		15.1