Western Beef Development Centre

EFFECT OF CONTROLLED RELEASE FERTILIZER (CRU®) ON PASTURE PRODUCTION

By: Dr. Bart Lardner, Research Scientist, WBDC

Introduction

Once a forage stand has been established, yearly maintenance costs are relatively low. However, productivity tends to decline over time as nutrients become bound up in the plant biomass and other less productive species invade the stand. Traditional renovation involves breaking and reseeding, expensive techniques that can increase the risk of soil erosion and degradation with an average cost of $80 to $100 per acre. Forage stand productivity has been increased using granular or liquid fertilizers along with adequate precipitation (Lardner et al. 2000). Fertilizer losses after application have been reported to be 25% to 30% of total application rates. Fortunately, new products exist to reduce these losses and to increase pasture productivity.

What is CRU®?

CRU® or controlled release urea is a fertilizer additive for dry bulk urea (46-0-0) and urea-ammonium nitrate (UAN: 28-0-0) solutions. CRU® enhances nitrogen fertilizer use efficiency by inhibiting the activity of the urease enzyme for up to 14 days. The active ingredient in CRU® is N-(n-butyl) thiophosphoric triamide (“NBPT”), delivered as a 20% by weight solution of the active ingredient. The NBPT is in a mixed solvent consisting of 8% by weight N-methyl pyrrolidone (“NMP”) with the balance of the solvent consisting of non-hazardous solvent and inert ingredients. In addition, CRU® reduces the loss of ammonia by volatilization when used in surface applications. Volatilization is the loss of nitrogen into the atmosphere when urea converts to gaseous ammonia. CRU® is usually applied to nitrogen fertilizer at a local fertilizer dealership equipped with a dry bulk blending facility.

Objectives

The objectives of this study were to evaluate the effects of CRU® (slow release fertilizer) on forage dry matter yield (DMY) and quality as compared to a conventional liquid fertilizer, urea-ammonium nitrate (28-0-0). The liquid fertilizer was applied at two different rates. The site was an established 6-year old, low-yielding pasture consisting of 98% meadow bromegrass (*B. riparis* Roem. & Schult.; cv. Paddock), and 2% cicer milkvetch (*A. cicer* L.; cv. Oxley). The 72-acre pasture was divided into three, 6-acre replicates of each fertilizer treatment. Treatments included check, liquid urea-ammonium nitrate (28-0-0) dribble banded at 50 and 100 lb/acre, and granular CRU® broadcast at 50 lb/acre.

Field Management

Topography at the pasture site is gently to moderately hummocky and the soils were a mixture of Oxbow Orthic Black with a loam texture. Soil samples were taken late April prior to treatment application and analyzed for nitrate-nitrogen (N), phosphorous (P), potassium (K) and sulfur (S). Soil test results indicated available NO_3-N levels of 12 lb/acre, P_2O_5 at 37 lb/acre, K_2O at 704 lb/acre, and S levels of 24 lb/acre.

All fertility treatments were applied early May 2004 once field conditions allowed access by floater equipment. CRU® was applied as a granular product at 50 lb/acre. Liquid nitrogen (28-0-0) was dribble banded at either the same rate (50 lb/acre), or double the annual rate (100 lb/acre). Forage dry matter yield (DMY) was determined throughout the summer at four different clip dates, June 16, July 22, July 28 and August 20. Clipping samples were collected from each treatment strip, ten (10) randomly placed 0.25 m^2 quadrats. The sample material was bagged, labeled, dried in a forced air oven at 65°C for 48 hours, weighed, and DMY (lb/acre; T/acre) calculated. Dried samples from two clip dates (June 16; August 20) were then submitted for laboratory analysis of total digestible energy (TDN) and crude protein (CP).

Results

Pasture productivity, reported as dry matter yield (DMY) ranged from 1.06 to 2.17 tons per acre. Fertility treatments yielded significantly greater DMY than the control areas, 105%, 93%, and 56% for CRU®, LIQUID100 and LIQUID50, respectively. Averaged over the summer, CRU® produced 32% more DMY than liquid fertilizer applied at the same rate. Urea-ammonium nitrate (28-0-0) applied as liquid at 100 pounds per acre yielded 4094 lb/acre compared to the CRU® treatment which yielded 4340 lb/acre (Table 1).

Table 1. Dry matter yield of fertilizer treatments

	June 16		July 22		July 28		August 20		MEAN	
	lb/ac	T/ac	lb/ac	T/ac	lb/ac	T/ac	lb/ac	T/ac	lb/ac	T/ac
CONTROL	2947	1.47	1393	0.70	2353	1.18	1777	0.89	**2117**	**1.06**
LIQUID 50	3478	1.74	2683	1.34	3769	1.88	3237	1.62	**3292**	**1.65**
LIQUID 100	5030	2.51	4527	2.26	3667	1.83	3154	1.58	**4094**	**2.05**
CRU® 50	5653	2.83	4263	2.13	3837	1.92	3605	1.80	**4340**	**2.17**

Forage quality of the treatment areas was greater than the control plots throughout the summer (Table 2). Energy content or the total digestible nutrients (TDN) of pasture samples from LIQUID100 and CRU®50 in June were 13% greater than the control samples. This was similar for the August samples, with TDN values 18% greater than those from the control areas. Crude protein (CP) content of LIQUID100 samples was greater than the control samples, 15.3% to 9.4%, respectively. Protein levels were similar between CRU®50 and LIQUID100 samples.

Table 2. Forage quality of pasture treatment areas (%)

Date	CONTROL		LIQUID 50		LIQUID 100		CRU® 50	
	TDN*	CP	TDN	CP	TDN	CP	TDN	CP
June 16	61.0	9.4	65.0	12.1	68.2	14.6	68.7	15.3
August 20	50.5	5.6	52.9	6.4	58.4	9.1	59.6	9.3

*TDN=total digestible nutrients; CP=crude protein

Costs

Costs associated with the project include urea-ammonium nitrate (28-0-0) priced at $0.11 per pound and CRU® at $0.21 per pound. Fertilizer application costs were $5.00 per acre. Therefore, calculated costs of LIQUID50, LIQUID100, and CRU®50 are $10.50, $16.00, and $15.50 per acre, respectively. With respect to the LIQUID50 treatment, by spending $10.50/acre, production increased by 1175 pounds. This works out to 0.9 cents per pound of additional forage. The LIQUID100 treatment cost $16/acre, producing an additional 1977 pounds, which works out to 0.8 cents/pound. Finally, the CRU®50 treatment, costing $15.50/acre yielded 2223 lbs, which is valued at 0.7 cents/pound.

Conclusions

During the year of application and compared to the control, urea-ammonium nitrate (28-0-0) and CRU® applied at 50 lb/acre increased production 56% and 105% respectively. For the additional cost of $4.00/acre, the increase in yield can easily be justified. The pasture production was doubled with the CRU®50 fertilizer at a value of 0.7 cents for each additional pound of forage. This study indicates the potential of CRU® as a slow release source of nitrogen in a pasture fertility program.

Acknowledgements

Appreciation is extended to Blair's Fertilizer Ltd. from Lanigan, Saskatchewan for in-kind support for this project.

References

Lardner, H.A., Wright, S.B.M., Cohen, R. D. H., Curry, P. and MacFarlane, L. 2000. The effect of rejuvenation of Aspen Parkland ecoregion grass-legume pastures on dry matter yield and forage quality. Can. J. Plant Sci. 80: 781-791.