Western Beef Development Centre

LIVESTOCK MANURE ON PERENNIAL PASTURE

Introduction

The growth of livestock production on the prairies has been accompanied by a growing need to address the issue of manure management. Increased costs of applying an inorganic fertilizer has led to the increased use of cattle manure as a nutrient source. Manure is beneficial to crops when applied at appropriate rates, but can create soil, water and air quality problems when over-applied. The Western Beef Development Centre is pursuing ways to not only manage that resource, but to take advantage of its nutrient value.

Manure is generally applied at rates to meet the nitrogen requirements of crops; however this may leave potential for a build-up of phosphorus at the soil surface, which is capable of contaminating surface water by runoff. To reduce the effects of "P- loading," researchers are evaluating the environmental impact of this input.

Laboratory studies continue to assess the potential salinity and P-loading problems after repeated applications of fresh feedlot manure.

In this demonstration project, plots were monitored to determine changes in soil nutrient levels and forage production as affected by various application rates of fresh manure.

Crested Wheatgrass & Russian Wildrye Pasture

In July 1998, solid cattle manure was applied to both crested wheatgrass (CWG) and
Russian wildrye (RWR) pastures at the Termuende Research Farm, 5 miles east of
Lanigan, SK. Rates of 60 and 30 tonnes per acre were applied separately to each of two paddocks of each pasture type. Project areas averaging 10 to 15 acres were then compared to a control area, which received no manure.

Soil Nutrient Levels

Soil samples were taken prior to manure application (0-12 inches) in July/98 and after in April/99 for soil nutrient analysis (**Table 1**). Pre application levels of nitrogen (N), phosphorous (P), potassium (K) and sulfur (S) indicated low N and P levels and sufficient K and S.

Manure Nutrients

Manure samples were analyzed for levels of N, P, K and S. According to lab analysis, manure applied at the rate of 30 tonnes per acre provided 216 lbs. N/ac., 78 lbs. P/ac.
246 lbs. K/ac. and 84 lbs. S/ac. Manure applied at 60 T/acre supplied 432 lbs. N/ac., 156 lbs. P/ac., 492 lbs. K/ac. and 168 lbs. S/ac.

Results

Soil test results showed low levels of nitrogen pre and post manure application on the crested wheatgrass **pastures (Table 1**). Moderate levels of available N were observed on Russian wildrye paddocks. This would indicate that the grass species are utilizing manure nitrogen during fall and spring growth, however much of the applied N is not available to the forage. Other studies have shown that much of the nitrogen contained in surface applied manure is lost to leaching, runoff and volatilization. Available phosphorous levels were low on crested wheatgrass (14 lb/ac) and Russian wildrye (24 lb/ac) pastures before manure was applied in 1998. However, after manure was applied at 30 T/ac, P levels were eight times greater on the crested wheatgrass and five times greater on Russian wildrye pastures the following spring. This would indicate that the manure is supplying more phosphorous than is needed by the pasture and soil levels after application are evidence of this theory.

Table 1. SOIL NUTRIENT LEVELS (LB/AC)

	N	P2O5	K2O	S
1998				
CWG1	35	14	1020+	82+
1999				
CWG2 30 T/acre	24	113	1200+	91
CWG2 60 T/acre	33	120+	1200+	96+
2000				
CWG3 30 T/acre	30	120+	1200+	96+
CWG3 60 T/acre	54	120+	1200+	96+
1998				
RWR1	77	24	1020+	82+
1999				
RWR2 30 T/acre	56	106	1200+	96+
RWR2 60 T/acre	87	120+	1200+	96+
2000				
RWR3 30 T/acre	60	120+	1200+	96+
RWR3 60 T/acre	59	120+	1200+	96+

[1]soil test July 98; [2]soil test April 99; [3]soil test April 2000

Table 2. 1999 PASTURE PRODUCTION

Pasture Type	Manure Rate (TONNE/ACRE)	Dry Matter Yield (LBS/ACRE)
CWG	0	2558
CWG	30	3893
CWG	60	4212
RWR	0	1988
RWR	30	2239
RWR	60	2690

Grazing Days

Due to adequate spring moisture conditions, pastures were grazed in mid-summer 1999, providing 277 and 320 animal grazing days/acre (AGD/ac) for the crested wheatgrass pastures receiving 30 and 60 T/acre manure, respectively.

Russian wildrye pastures provided 144 and 153 AGD/ac for the paddocks receiving 30 and 60 T/ac, respectively. In summer 2000, crested wheatgrass pastures provided 189 and 272 AGD/ac for the 30 and 60 T/ac, respectively. Russian wildrye pastures provided 158 and 223 AGD/ac for the paddocks receiving 30 and 60 T/ac, respectively.

Pasture Production

Pastures were also evaluated for forage yield under the various treatments (**Table 2**). Dry matter yield (DMY) was determined in June 1999 by clipping ten 0.25 m_2 quadrats per paddock. Comparisons are between treatments and against the check areas.

Crested wheatgrass pasture receiving 30 and 60 T/ac livestock manure yielded 52% and 65%, respectively more DMY than the check area. DMY of Russian wildrye pastures receiving 30 and 60 T/ac was 13 and 35% greater than the pasture receiving no manure.

Costs

Costs associated with this project were $20/acre to apply manure at 30 T/acre, and $40/acre to apply at 60 T/acre. These costs are calculated based on custom rates. With respect to the CWG, by spending $20/acre, pasture production increased by 1335 lbs. This works out to 1.5 cents per pound of production. At 60 T/ac, the increase in forage production is a valued at 2.4 cents/pound. The returns on the RWR were much lower. At 30 T/ac the increased production cost was 8 cents/pound, while at 60 T/ac the increase in production cost 5.7 cents/pound.

Manure Application

The decision to apply livestock manure on established perennial pastures must be timed in accordance with the period of use. In this study, manure was applied mid-summer and pastures were not grazed until the following spring. Following application the pasture was harrowed to allow for leveling, breakdown and distribution of the manure. In 1999, it was observed that cows grazing the pasture, which received 60 T/ac manure initially, lacked acceptance for the first week to graze the pasture sward.

The use of solid cattle manure to supply needed nutrients to established forage stands is an alternative to inorganic fertilizers. With rising prices for inorganic fertilizers producers are realizing the benefits of livestock manure. However, this project would indicate levels greater than 30 T/ac not be recommended due to buildup of P in the soil and the manure affecting grazing by the animals.