PLANT NUTRITION TODAY

2017 ISSUE 1, NO. 8

IMPROVING PRODUCTIVITY OF PERENNIAL MIXED FORAGE STANDS

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Evidence-based stewardship applies proven science-based principles to management decisions with full consideration of the characteristics of the specific site and the needs of the specific production system. Key soil properties are an essential subset of site characteristics. The many tame pastures of central British Columbia, Canada offer an excellent example. These pastures are the result of former forested land being logged for lumber, then cleared and converted to grazing land. After tree stumps and roots are piled and burned, the land is smoothed out and large rocks removed before broadcast seeding, and harrowing to mixed forage stands. The mixed forage stands will often consist of a mixture of cool grass species such as brome and timothy grasses, and legumes species such as clovers and spreading alfalfa. Many ranchers and mixed farm operators graze beef cattle on these pastures and don't see the need of applying supplemental nutrients as fertilizers, or use soil amendments. However, some significant improvements in productivity of these pastures can be realized with modest applications of fertilizers, as well as lime ($CaCO_3$) and gypsum ($CaSO_4$). Improvement is noticed by increased carrying capacity of pastures, and greater weight gain by livestock.

These formerly mixed wood forest soils are commonly called call Gray Wooded [Gray Luvisolic, (Canada), Boralf (U.S. Soil Taxonomy), and Albic Luvisol (FAO Soil Classification)]. The soils tend to be neutral to moderately acidic in pH (pH 5.5 to 6.5), they are

Miles Dyck/Univ. Alberta

Gray Wooded soil profile (left) with decomposed leaf litter on surface over a leached mineral surface layer. A grassland soil profile contrasts on the right.

organic matter (<2%), and comparatively low in plant available N, P, and S.

By applying fertilizer nutrients and soil amendments forage quantity and quality can be enhanced. Each forage species has its own need for soil conditions. In the mixed forage stands mentioned above alfalfa is less tolerant of soil acidity, and will do less well, compared to the grass species or clovers when soil pH is between 5.0 to 6.0. This is primarily due to the adverse effect acidity has on the *Rhizobia* bacteria that inhabit root nodules of the alfalfa. Acidic conditions result in poor nodulation of the alfalfa and N fixation is low, making alfalfa less competitive with the other forage species in the seeded mixtures. A benefit of applying granulated lime to raise pH slightly, and granulated gypsum to supply sulfur is the improved growth of alfalfa in the pasture stand that increases forage yield and especially an improved protein source for the grazing cattle.

Thirty-five years of research from the University of Alberta Breton

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"Thirty-five years of (Breton Plot) research clearly shows the benefit of balanced nutrition along with lime applications every few years to maintain soil pH above 6.0."

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Lime, gypsum, and P fertilizer (right) resulting in increased clover and alfalfa in stand, compared to nothing applied on the left resulting in mostly grass and bushy species present.

Plots, near Breton, AB, clearly shows the benefit of balanced nutrition (N, P, K, and S), along with lime applications every few years to maintain soil pH above 6.0. When the soil is not limed the alfalfa in the stand is significantly less and volunteer white clover and grass species dominate. An alfalfa grass mixture is preferred for hay production compared to a combination of white clover and grasses.

In most situations, an application of fertilizer nutrients, along with lime applications can improve grazing forage production or hay production, on the formerly forested soils. It also allows forage species to better outcompete weeds. A modest investment in plant nutrients, and applying lime to amending the soil pH, can be a positive return on investment.

Table 1. Effect of liming along with N, P, K, and S fertilizer, on species composition of first cut hay in a mixed forage stand. U of A Breton plots. Adapted from Puurveen and Olson, 2006.

Forage yield, t/A	Soil pH	Nutrients applied	Lime applied every 5 years as needed	Percent of forage species in hay cut			
				Bromegrass	Alfalfa	White clover	Weeds
1.3	5.3	N, P, K, and S	No	34	1	64	1
1.5	6.6	N, P, K, and S	Yes	17	43	34	6
0.8	5.9	None	No	44	30	19	7

Dick Puurveen/Univ. Alberta

No lime (far middle left) versus lime applied on right, U of A Breton Plots.

References

Puurveen, D. and C. Olson. 2006. Effect of Volunteer Clover on Forage Yield at Breton Plots. Poster in Proceedings of 2006 Alberta Soil Science Workshop.

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