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Look beyond NPK for Top Yields of Improved Grass Forage, Studies Show

Research in Kansas and Missouri Illustrates Benefits of Balanced Soil Fertility Program

New research shows that improved grass production benefits from balanced fertility.

At least 5 million acres of improved pasture blanket the wide, open spaces of the Great Plains, representing a significant portion of this region's agricultural economy. Recent research in Kansas and Missouri shows that producers can greatly enhance their perennial grass ROI with one simple practice: balanced soil fertility.

According to Dr. Joe O'Connor, manager of agronomic services for IMC Global, this means providing the appropriate balance of all the essential nutrients, not just one or two.

"If one or more nutrient is lacking, yields will be reduced even though an adequate amount of the other elements are available," he says. "The most limiting nutrient serves as the cap on yield."

This concept, known as Liebig's law of the minimum, is especially important during tough economic times, O'Connor adds. Cutting back on applications of critical secondary and micronutrients to shave costs will only further limit the economic payback because yields will suffer.

"If a soil is deficient in magnesium, for instance, yields will be depressed regardless of how much N-P-K is applied," he says. "Balanced nutrition is the key to recouping profit potential through increased yields. Few farm investments pay greater dividends than fertilizer. Used efficiently, returns of \$3, \$4, \$5 or more are possible for each dollar invested in fertilizer."

Kansas Research

Bromegrass yields increased by more than 1,000 pounds per acre in a Miami County study when potassium (K) and sulfur (S) were added to a fertilizer program consisting of nitrogen (N) and phosphorus (P).

Dr. Ray Lamond, Extension Soil Fertility Specialist at Kansas State University, conducted research in which he sequentially added essential macro and secondary nutrients in the appropriate rates. The rates used in this study were N=90 lbs, P₂O₅ =20 lbs, K₂O= 30 lbs and S=10 lbs/A. All sites were low to medium in available P. Applications were made in February with harvest following in May (Table 1).

Table 1. Bromegrass yields from low P soils fertilized in February.

Treatment	Miami Co. S	Miami Co. N
0	2,190	1,600
N	5,100	3,210
N&P	5,290	4,160
NPKS	5,800	5,360

Adding K and S to bromegrass fertility program significantly boosted yields, particularly in the Miami County N study.

In both locations, forage yields were increased by N application. N fertilization also increased forage protein levels. P fertilization increased brome forage yields, particularly at sites with low soil P tests. At Miami County N, N significantly increased forage production. N&P did not provide a significant yield increase over N alone, but the NPKS treatment was superior to the other fertilizer treatments.

Table 2. Bromegrass yields (lb/A) at Southeast Kansas 2001

	Miami Co. H	Miami Co. W.
0	2,430	2,180
N 80 lbs/A	5,890	5,370
N & P @30 lbs/A	7,440	5,910
N+P+S at 20 lbs/A	7,890	6,650

Bromegrass is recognized as being a responder to S.

Furthermore, Table 2 demonstrates that the addition of S fertilizer consistently produced higher yields. Adding 20 lbs of S yielded an extra 600 lbs of forage in Miami County H and W locations.

At the H site, there was a significant advantage to adding N, and N&P. However, the NPS treatment was not better than the N&P treatment at this location. It is apparent that good efficacy of applied N will not be achieved until P needs are met. At the W site, there was a significant difference from adding N. The N and the N&P were similar. The NPS treated plots produced the most bromegrass hay in this comparison.

O'Connor says these findings underscore the need for balanced fertilization on improved grasses. Yields cannot be optimized with N alone.

"Nitrogen shows a good response," he says. "But as soon as you start supplying a balanced fertility package, the yields really begin to climb."

Missouri

Research conducted by Dr. Dale Blevins and coworkers, who have extensively studied nutrient interactions at the University of Missouri Mt. Vernon Experiment Station, showed that P and Mg interact to reduce grass tetany hazards in tall fescue pastures.

O'Connor suggests that many nutrient interactions can be compared to the compounding effect in financial investing. "Wise investors let the power of compounding work to their advantage, allowing large earnings to grow from a relatively small investment," he says.

"While crop nutrients will not magically reproduce themselves quite in this manner, they do enhance each other's performance, creating a compounding effect."

In March the plots were divided and topdressed with 25 lbs P/A. All plots received N and K as required. Leaf tissue samples were collected and analyzed three times in April. Forage yields were determined in the spring and fall harvests.

Applying 25 lbs of P dramatically increased the tissue level of Mg, Ca and P at the low soil P levels (Table 3). The response to tissue Mg and P to added P was less dramatic at the intermediate (51 LB P/A) rate. The response to P in the higher P soils was not consistent.

Table 3. Leaf Mg and P levels under different Soil P and fertilizer P treatments.

Soil P	P - Rate	Mg	P
26	0	2.1	1.3
	25	2.9	3.7
51	0	2.7	2.0
	25	2.9	3.5
91	0	2.8	3.0
	25	2.8	3.8

Table 4 reveals the tremendous payback opportunity that exists for growers who apply P fertilizer to soils testing low to medium in P. At the low soil P level, adding 25 lbs/A of P more than doubles the hay yield. Figuring \$30/A for fertilizer and a fescue value of \$75/A, the above scenario results in a \$55/A net return.*

**Accounts for P fertilizer costs only.*

Table 4. Average hay yields (lbs/A) at different soil P levels and P application rates.

Soil P	P- Rate	May hay yield
26	0	1,477
	25	4,354
51	0	3,421
	25	4,425
91	0	3,479
	25	4,158

Adding P fertilizer to soils testing low to medium in this nutrient resulted in significant yield increases.

Conclusion

- Additional P was the key to optimum hay yields. In Kansas, N use efficiency was enhanced. In Missouri, better forage yield and quality resulted.
- In Kansas, bromegrass typically responds to S with increased yield. Balanced fertilizer blends produced more forage than most other treatments.
- In Missouri, either soil test P or P applications supplied a low probability for grass tetany. High mineral content (Ca, Mg and P) of fescue forage will allow calculation of low grass tetany potential.



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