Alfalfa (Medicago sativa L.) growth, forage yield and quality, and soil properties under three broiler litter regimes: short-term effects

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RATIONALE

Alfalfa crop, grown widely in Kentucky provides forage base for local beef, dairy, and horse industries. Afalfa typically meets crop N requirement through symbiotic N_2 fixation, but can preferentially utilize mineral N, if it is available. Application of manure to alfalfa decreases symbiotic N_2 fixation (Peterson and Russelle, 1991) and result in more efficient use of manure N. Ability of alfalfa to recycle manure nutrients and capacity to extract nutrients from deeper soil depths provides economic and environmental justification for manure use for alfalfa production(Schmitt et al., 1991).

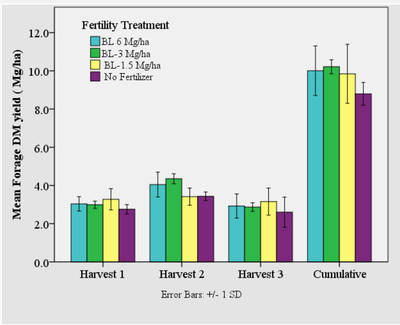
OBJECTIVE

To evaluate effects of different P requirement based broiler litter amendment rates on forage growth, dry matter yield, quality, and soil properties.

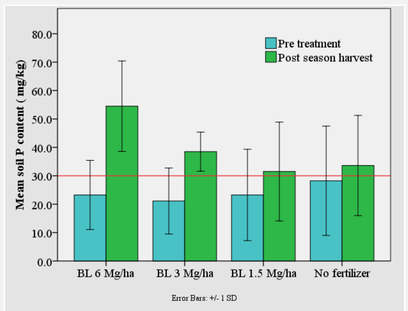
APPROACH

- Sixteen alfalfa plots (6 x 3 m) were established in fall 2016 and were let grow until spring 2017.
- Experimental design was complete randomized block design with 4 replicates.
- Before imposing fertilizer treatments in spring 2017, foliage in all plots were trimmed to 10-12.5 cm height.
- Broiler litter used in this experiment had 2.9% N, 0.8%P, 2.6% K. 1.01% S, and 0.003% B.
- P rate based four fertility treatments (full rate targeted 8MT/ha yield) were
  1. Broiler litter full P rate. (6 Mg/ha) with P, K, S, and B if required by chemical fertilizer
  2. Broiler litter 50% P rate. (3 Mg/ha) with P, K, S, and B if required by chemical fertilizer
  3. Broiler litter 25% P rate.(1.5 Mg/ha) with P, K, S, and B if required by chemical fertilizer
  4. Control. No manure or chemical fertilizer
- Forage harvesting was done at 25% flowering stage three times.
- For DM yield estimation, 1 m^2 area was harvested and sub samples from harvests were used for forage quality analysis. Forage quality was determined by NIR method.
- Between each forage harvesting period, NDVI (Noramalized difference vegetation index) values for each plot were recorded weekly using GreenSeeker™ technology (Reynolds et al.2015), ,

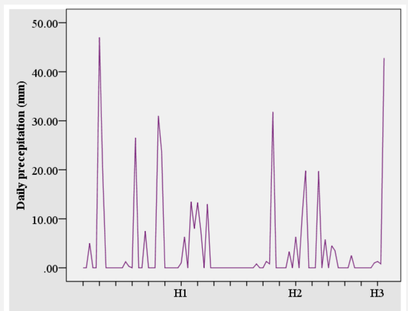
Forage dry matter yield



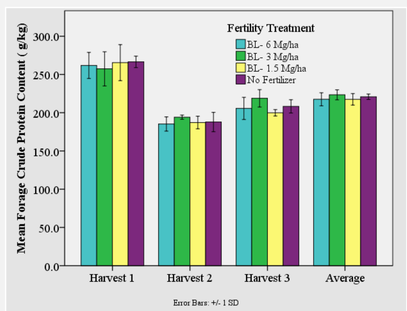
Soil P content



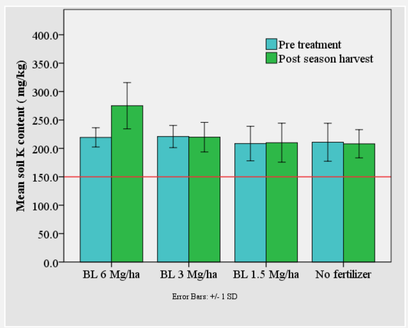
Growing season - Precipitation



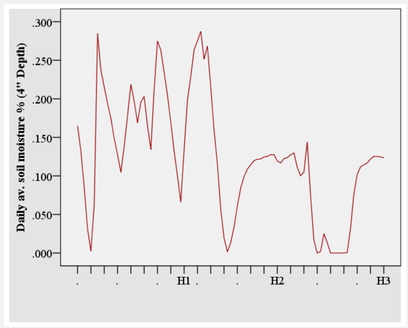
Forage crude protein content



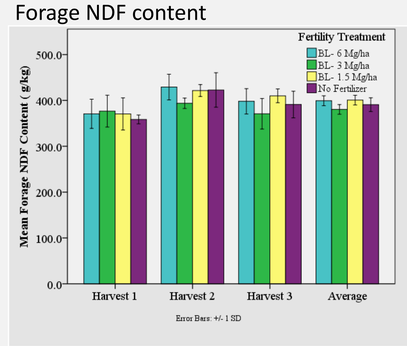
Soil K content



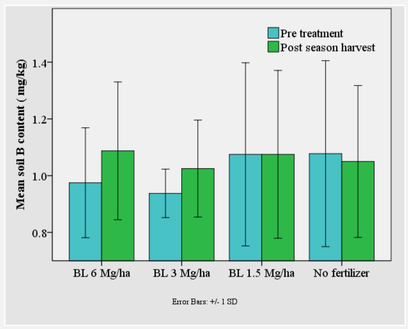
Soil moisture at 4" depth



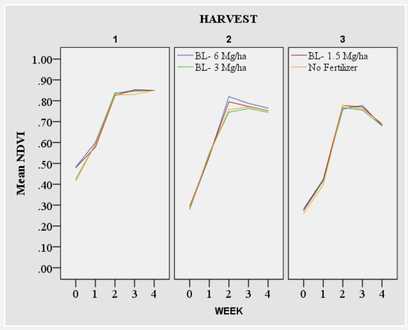
Forage NDF content



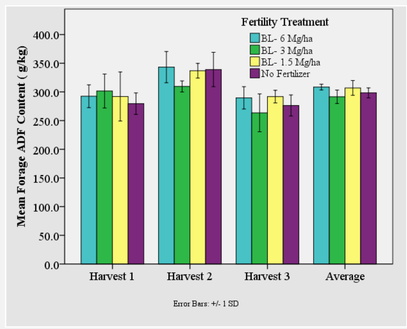
Soil B content



Forage Growth NDVI



Forage ADF content



References

Peterson, T.A. and M.P. Russelle. 1991. Alfalfa and the nitrogen cycle in the corn belt. Nourn. Soil and Water Conserv. 46: 229-235.

Reynolds, A.G., R. Brown, E. Kotsaki, and H.S. Lee. 2015. Utilization of proximal sensing technology (Greenseeker) to map variability in Ontario vineyards. In *Proc. 19th International Symposium GiESCO, Gruissan, France, 593-597*

Summery

- Initial and post season soil K and post harvest soil P contents of all treatments exceeded crop requirement (30 mg P/kg and 150 mg K/kg)
- During first growing season, either forage yield or forage quality did not differ significantly among fertility treatments.
- Weekly NDVI values within each harvest were similar among treatments and all treatments followed same trend.
- Broiler litter 6 MG/ha rate significantly elevated soil P and K levels and 3 MG/ha rate elevated soil P levels within 1st year.

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