Grass and Nutrient Management

The sustainability of agricultural systems depends on the ability of the system to be productive while minimizing external inputs. Good soil management maintains air and water quality, and supports plant and animal life. Perennial grasses are beneficial to the environment by minimizing soil erosion, increasing water infiltration, and promoting biological activity for a healthy soil.

Nutrient balance on a livestock farm is essential for sustainable, economically-feasible livestock production. Home grown grass forages can benefit nutrient balance both by removing excess nutrients and by minimizing off-farm imported nutrients.

Buffers are sometimes required to reduce water erosion. A percentage of the field is taken out of production to provide a vegetative barrier to increase filtration, slow water runoff velocity, and shorten slope length to allow deposits of sediment to occur in the field. Perennial grass fields do not need any type of buffer.

Figure 1. Perennial grasses are suited to all agricultural soil types, minimize erosion, minimize pesticide applications, and are compatible with manure and nutrient management practices.

Animal Manure Application

Perennial grasses can provide environmentally acceptable sites for manure nutrients. Animal manures supply both nutrients and organic matter to soil, however, manures can negatively impact harvested forage through excessive nutrient concentrations or through surface contamination if not applied judiciously. The type of animal generating the manure, the amount of excretia vs. bedding or litter, and the manure storage system all affect application and use of manure. Manure use for the establishment of new perennial grass seedings may increase yields if the soil is deficient in P, K, S, or B.

Inclusion of an annual companion crop can minimize N losses while the perennial crop is establishing. Manure application to established grass stands to meet the N requirements of the forage crop will result in excess P application, with the additional disadvantage of N volatilization losses. Partial incorporation of manure using an aerator/tillage tool should reduce volatilization losses.

Management Effects on Runoff

Surface runoff and erosion may contaminate surface waters with P as well as manure pathogens. In general, perennial grasses reduce soil erosion by protecting the soil surface from raindrops. Raindrop energy is dissipated, preventing them from dispersing soil aggregates, thus increasing filtration and minimizing runoff. Forage plant growth habit and rooting architecture significantly impact runoff and infiltration.

Perennial grasses may serve a dual purpose as a forage crop and as a conservation buffer. Buffer strips of perennial grasses can play a major role in minimizing nutrient flow into surface waterways. Contour buffer strips, field borders, filter strips, and grassed waterways may all be used for forage production.

Care should be taken when harvesting

conservation buffers that are more likely to have wet soils, such as filter strips and waterways. Forage harvesting equipment could produce ruts in any field, depending on soil moisture and soil type. Operating harvesting equipment on wet fields not only results in soil compaction that decreases infiltration and potentially increases runoff, but can also increase runoff by providing channels for water flow, depending on field slope and channel orientation.

Grass-Legume Mixtures

Forage mixtures (e.g. alfalfa-grass) can provide high quality forage while eliminating or minimizing fertilizer N inputs and maximizing protection from both runoff and leaching. Grass species that are sod-forming with robust root systems such as reed canarygrass, will minimize runoff. Species such as timothy, with much lower apparent N recovery and lower CP content, requiring more supplemental N in cattle diets, should be avoided.

Nutrient Applications and Harvesting

Fields devoted to harvested forage lack the inherent nutrient recycling found in pasture systems. Replacement of nutrients removed is required for a sustainable system, and soil testing is essential for documenting nutrient changes in soil over time. Fertility management of mixed perennial forages can have dramatic effects on the species mixture.

Removal of nutrients by harvested forages can be estimated using published forage composition tables, however, composition of a particular field may deviate greatly from average values. Since both yield estimation and forage analysis are essential for practices such as precision feed management, this data can also be used to help assess fertilizer needs for the crop.

Feeding of Grass Forage

Just as over-fertilization of field crops was common in the past, over-feeding of cattle was also viewed as cheap insurance for maximizing productivity. Forage crops can be managed and harvested to produce optimum quality forage for a given class of livestock. Ration balancing can eliminate nutrient deficiencies but nutrient excess in forages is most effectively controlled with fertility and harvest management.

Increased number of harvests will increase apparent N recovery and increase forage quality for precision feed management. Precision feed management should be undertaken by dairy farmers. The monitoring and record keeping involved will minimize nutrient losses in the system. Harvest management for high quality is essential.

Summary

Strict guidelines for manure applications on forage crops will minimize environmental concerns and animal pathogen issues. Partial incorporation of manure on forage lands will minimize surface runoff risk. Perennial grasses leave residue on the field, increase water conservation in the soil, improve water quality of large bodies of water, build soil organic matter, and reduce runoff and soil erosion by water and wind. Use of perennial grasses results in a positive environmental outcome, with cleaner air and water.

Additional Resources

- 2011 Cornell Guide for Integrated Field Crops Management. Electronically accessible at: http://ipmguidelines.org/Fieldcrops/.
- Cherney, J.H., and R.L. Kallenbach. 2007. Chapt. 18. Forage Systems in the Temperate Humid Zone. Pages 277-290. In (R.F. Barnes et al., ed.) Forages: Vol. 2. The Science of Grassland Agriculture. 6th ed., Blackwell Publishing.

Disclaimer

This information sheet reflects the current (and past) authors' best effort to interpret a complex body of scientific research, and to translate this into practical management options. Following the guidance provided in this information sheet does not assure compliance with any applicable law, rule, regulation or standard, or the achievement of particular discharge levels from agricultural land.

For more information

Cornell University Cooperative Extension

Grass Management Manual
http://forages.org

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