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AGRONOMY AND SOILS SERIES

TIMELY INFORMATION
Agriculture & Natural Resources

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S-02-06 March, 2006

Intensive Cropping Systems for Nutrient Management in Alabama

There are situations where a producer may have an excess of nutrients that he/she must dispose in a safe way on a regular basis. Many animal feeding operations with liquid manure systems fit into this category. These operations are looking for an intensive cropping system that can utilize as much nutrients as possible on a relatively small acreage. Small acreage is important because transporting wet manure with honey wagons or pumping liquids is difficult and expensive. Recycling nutrients also saves on fertilizer purchases.

A major disadvantage in any animal feeding operation is that animal waste generally has about the same concentration of N as P_2O_5. Plants generally need about 3 to 5 times more N as P_2O_5. Therefore, even with the best cropping system we will always have a surplus of P on a farm that uses animal manures as a principal source of crop nutrients. Another concern is that when large quantities of biomass are removed from a field (hay, silage, or crop residues), almost as much K_2O as N is removed. If this is not replaced, K deficiency could become a problem after a few years. An additional concern with regular use of animal waste is the buildup of certain metals in the soil that may be a component of imported animal feeds. Copper is a common additive in many livestock feeds. To some extent, this can be adjusted in the feed ration.

The most efficient nutrient removal system for Alabama will use a combination of both warm- and cool-season crops to remove nutrients year round. The following systems are examples that could work under Alabama conditions. No system is perfect, and all require intensive management for them to actually use the nutrients applied. High yields of all crops are important for maximum nutrient removal. Frequent soil testing (annually) helps to monitor soil pH, buildup of P and depletion of K. Micronutrient testing can monitor metals such as copper and zinc. Soil testing is the basis for any nutrient management plan.

System 1
Hybrid Bermudagrass Hay with Rye overseeded in the fall

Adaptability. This system can be used statewide but yields and nutrient uptake will be greater in the southern part of the state. Bahiagrass could be used in place of hybrid bermudagrass in the southern counties with slightly lower nutrient uptake. Bermudagrass requires well drained soils, and will not tolerate saturated soil conditions.

Advantages. Potentially, this could be the most nutrient intensive system for Alabama. This system does not require the level of management as system 2. It can be used statewide and works well on rolling land as long as irrigation can be applied. Good quality hay can be sold off the farm thus removing nutrients from the local farm system. Cereal rye will give sufficient fall and winter growth for some nutrient application during this period if needed. Rye could be grazed in late fall and winter if needed. This system could remove as much as 500-110-430 pounds N-P_2O_5-K_2O per acre per year.

Disadvantages. This system is sensitive to too much water. It does require frequent hay harvests during the growing season. Bad weather could interfere with timely harvest of hay. Establishing rye into bermudagrass and harvesting the rye in early spring can be a challenge. It must be removed early to prevent harming the emerging bermudagrass in the spring.

Nutrient budget – System 1.

Crop	Application*	Timing	Critical N Application Rate (lb/a)	Anticipated Yield** (ton dm/a)	Nutrient removal, N-P_2O_5-K_2O (lb/a)
bermudagrass	1st	April	100	2	100-24-86
bermudagrass	2nd	June	100	2	100-24-86
bermudagrass	3rd	July	100	2	100-24-86
bermudagrass	4th	Sept.	0	2	100-24-86
Cereal rye	planting	Oct.	60	0	0
Cereal rye	Late fall/ early winter	Nov.-Jan.	40	grazed	0
Cereal rye	Late winter	Feb./ Mar.	100	3	100-17-84
TOTAL ANNUAL			500		500-113-428

* Application may be split into multiple application during the period designated.
** Dry matter (dm) yields may vary considerably from farm to farm. Adjust nutrient removal based upon actual yield.

System 2
Corn or sorghum silage with rye or wheat green chop during the cool season

Adaptability. This system is best for a dairy or feedlot operation where silage and/or green chop can be fed directly in the animal feeding operation. The corn silage system is often used in the upper Midwest on small dairies.

Advantages. This system could use as much as 300-100-310 pounds N-P_2O_5-K_2O per acre per year.

Disadvantages. This intensive system requires planting and harvesting 2 crops a year. There will be times during the cool season when plant growth is minimal and nutrients should not be applied either

due to adverse weather or inadequate growth. Nitrogen and potassium (K_2O) from fertilizers may have to be applied to supplement animal manures.

Nutrient budget – System 2.

Crop	Application	Timing	Critical N Application Rate (lb/a)	Anticipated Yield*	Nutrient removal (N-P_2O_5-K_2O)
Corn silage	planting	April	60		
Corn silage	V8 stage	May	100		
Corn silage		June	80		
Corn silage	dent	July	0	20 green tons/acre	200-80-200
(fallow)	none		0	0	0
Rye or wheat	planting	fall	60	grazed	0
Rye or wheat	Late fall/ early winter	Nov.-Jan.	30	grazed	0
Rye or wheat	Late winter/early spring	Feb-March	100	4 tons/acre (dry matter)	132-22-112
TOTAL ANNUAL			430		332-102-312
* Yields may vary considerably from farm to farm. Adjust nutrient removal based upon actual yield.					

System 3
Summer annual grass followed by small grain

Adaptability. This system can be used statewide but will give more growth of the summer annual grass in the southern counties. It can be used where the small grain crop is harvested for grain or allowed to mature for other reasons e.g. harvest of the straw. Summer annual grasses include sorghum, sorghum-sudangrass hybrids, pearl millet, browntop millet, etc. Sorgum-sudangrass hybrids will probably perform better in North Alabama than pearl millet. Crops that produce the most dry matter will also remove the most nutrients. Small grains include cereal rye (preferred for fall growth), wheat, oats, and triticale. Ryegrass could be used in this system but will result in more growth later in the spring thus delaying planting of the summer annual grass.

Advantages. This system can be used where the small grain must be harvested for grain in May or early June and/or the producer wishes to use or sell the straw. Harvesting the straw is important for maximum nutrient removal. The summer annual can be harvested for silage, green chop, or hay.

Disadvantages. Crops can vary widely in dry matter yield potential and nutrient removal is largely growth dependent. This system is not as nutrient intensive as the previous systems but offers some flexibility in time of planting. Harvesting the summer annual grass about every 4 weeks can be challenging. Most summer annual grasses are very sensitive to acid soil so soil pH must be monitored carefully and lime applied as needed.

Nutrient Budget – System 3.

Crop	Application*	Timing	Critical Nutrient Application Rate (lb/a)	Anticipated Yield	Nutrient removal (N-P_2O_5-K_2O)
Pearl millet	At planting	June	60	0	0
Pearl millet	1st cutting	July	60	3 tons dm/a	54-21-48
	2nd cutting	August	60	2 tons dm/a	36-14-32
	3rd cutting	Sept.	0	1 tons dm/a	18-07-16
Small grain	At planting	Oct.-Nov	60	0	0
Small grain	Late winter	Feb./ Mar.	100	60 bu/a grain + straw	170-76-140
TOTAL ANNUAL			340		278-118-236

* Application may be split into multiple application during the period designated.
** Yields may vary considerably from farm to farm. Adjust nutrient removal based upon actual yield.

System 4
Summer annual grass interseeded with orchardgrass

Adaptability. This system should only be used in North Alabama. Orchardgrass does not yield as much dry matter as some other perennial grasses such as bermudagrass.

Advantages. Orchardgrass its takes up almost twice the amount of phosphorus per ton of dry matter removed than bermudagrass. It also takes up a substantial amount of potassium (K_2O). The summer annual can be harvested for silage, green chop, or hay.

Disadvantages. This system is limited to North Alabama where orchardgrass is adaptable. No varieties are adapted in Central and South Alabama. Nutrient concentrations vary among different species depending on the plant available nutrients in the soil, yield, and maturity of the forage when harvested. Orchardgrass is treated as a cool-season annual.

Nutrient Budget – System 4.

Crop	Application*	Timing	Critical N Application Rate (lb/a)		Nutrient removal (N-P_2O_5-K_2O)
Sorghum-sudangrass	At planting	June	60	0	0
Sorghum-sudangrass	1st cutting	July	60	3	54-21-48
Sorghum-sudangrass	2nd cutting	August	60	2	36-14-32
Sorghum-sudangrass	3rd cutting	Sept.	0	1	18-07-16
Orchardgrass	At planting	Aug.-Sept.	60	0	0
Orchardgrass	Late winter	Feb./Mar.	100	3	150-50-185
TOTAL ANNUAL			340		258-92-281

* Application may be split into multiple application during the period designated.
** Dry matter (dm) yields may vary considerably from farm to farm. Adjust nutrient removal based upon actual yield.

System 5
Tall fescue with hybrid bermudagrass

Adaptability. This system will be more suitable to North Alabama where tall fescue does well. Tall fescue is not as adapted to central and south Alabama but if adequate moisture is received it could be used as an additional option for those regions. Most of the cool-season growth of the fescue will be in the spring.

Advantages. Tall fescue persists throughout most of the fall and spring whereas bermudagrass grows in the summer. This will provide some year round growth and nutrient removal with limited competition. Tall fescue could also be overseeded with a warm-season annual grass such as crabgrass for summer growth if bermudagrass stand is weak. Both tall fescue and bermudagrass can grow on soils with a wide range of pH and can persist in droughty conditions.

Disadvantages. This system is primarily for North Alabama where tall fescue is adaptable. It should be noted that nutrient removal is accomplished only by removing forage as a hay crop and transporting the nutrients away from the application site. Grazing recycles the nutrients back into the system. Yields of both bermudagrass and fescue will be reduced over that expected where each is grown by itself.

Nutrient Budget – System 5.

Crop	Application*	Timing	Critical N Application Rate (lb/a)	Anticipated Yield** (tons dm/a)	Nutrient removal (N-P_2O_5-K_2O)
bermudagrass	1st	June	100	1.5 tons dm/a	75-18-65
bermudagrass	2nd	July	100	1.5 tons dm/a	75-18-65
bermudagrass	3rd	Sept.	0	1.5 tons dm/a	75-18-65
Tall fescue	Early fall	Sept.-Oct.	60	0	0
Tall fescue	Late fall/ early winter	Nov.-Dec.	30	grazed	0
Tall fescue	Late winter	Mar.-June	120	3.0 tons/a (dry matter)	120-27-144
TOTAL ANNUAL			410		345-81-339

* Application may be split into multiple application during the period designated.
** Dry matter (dm) yields may vary considerably from farm to farm. Adjust nutrient removal based upon actual yield.

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