FL651.0606 Nutrient removal by harvesting of crops

(c) Data Sources

When developing a nutrient budget, there are several sources of crop removal data that can be used to calculate waste utilization rates. The sources of data should be evaluated and the best source of data chosen to develop the nutrient budget.

On Farm Data. Sometimes a producer will have the cropping history of a particular crop that can be used in developing the nutrient budget. If the producer has kept accurate yield records, then this is potentially the best source of data for a nutrient budget. The planner should inquire about the past fertilization practices that created those yields to insure that the fertilization rate is reasonable. If fertilization rates were excessive, it indicates that over fertilization occurred and thus yields were inflated and excessive nutrient loss to leaching or surface runoff also probably occurred. In this case, on farm records would not be a good reference for crop removal data.

County Data. If on farm data is not available, then yield data of neighboring producers or producers, which are on similar soil types within the county, would be potentially the next best source for calculation of crop removal. The local county extension agent may be helpful in locating this type of data. Again, the same caution applies to this source of data. The fertilization practices should be considered to insure that reasonable fertilization rates were used.

AWMFH Amendment Recommendations. NRCS Florida has developed some information regarding crop uptake values and amended the AWMFH. This does NOT apply to the regular section within Chapter 6 of the AWMFH which is discussed below. Table FL 6-6a has values for bermudagrass/ryegrass rotation under different irrigation conditions for both hayland and grazing situations.

IFAS Recommendations. The University of Florida, Institute of Food and Agricultural Sciences (IFAS) has published "UF/IFAS Standardized Fertilization Recommendations for Agronomic Crops", SL-129 which contains fertilization recommendations for many commonly grown crops in Florida. IFAS SL-129 does state that the recommendations are based upon economic considerations for a typical producer and may not apply to a waste utilization situation. The reason for this is that as an example it may not be economical for fertilization of forage grass for beef operations based upon an economic return in terms of beef cattle weight gain versus money spent on fertilizer. Whereas, under a similar dairy operation where it cost money to distribute waste, it makes economic sense to apply waste at higher application rates as long as it does not create a water quality problem.

IFAS publications, other than SL-129, may have been produced with certain industries in mind. These publications should be used with caution. The planner must understand the nature of the recommendation(s) and the situation applicable for the recommendations.

AWMFH Data. The data within the AWMFH are based upon a national database of crop yields and nutrient concentrations. Since this data is national in scope, more localized data is preferable. Since local data is not always readily available, this data source provides a method for crop nutrient removal when not covered by one of the above data sources.

Research Data. Sometimes research data on a particular crop will be available. Since research data is collected for a variety of reasons, it may be that the yield data collected was collected for a situation for which it is not applicable to the same situation. This data can be used when no other data source exists.

(d) Hierarchical Order for Using Data Sources

In developing a nutrient management plan, the order in which data sources should be used is as follows:

(1) On Farm Data
(2) County Data
(3) AWMFH Amendments

(4) IFAS Recommendations
(5) AWMFH Data
(6) Research Data

(e) Multiple Cropping Systems

Typically, crop removal data is given for a single crop rotation. Occasionally a crop is grown which does not reach full maturity before it is harvested. Planners should be aware of the growing season of crops grown in multiple crop rotations to be sure that yield estimates are accurate. As an example, ryegrass is a cool season annual forage crop grown in Florida. The growing season for ryegrass is from November to May. This crop does much of its growth late in the season. Harvested at the end of its growing season, yields are typically 2 tons per acre. However, ryegrass grown in rotation with bermudagrass is not allowed to reach maturity since bermudagrass begins its season in March to April. The ryegrass may be harvested to allow the bermudagrass to begin growing or the growth of the bermudagrass may impede the growth of the ryegrass. Typically grown in this rotation, ryegrass yields are reduced to 1 ton per acre. Planners need to make adjustments in expected yields accordingly for crops grown within multi-crop systems.

(f) Nitrogen application rates for bermudagrass/ryegrass in dairy rotational grazing pastures and dairy waste application on hayland fields.

Nitrogen application rates are needed to assist with determining dairy stocking rates and animal waste application rates for proper nutrient management. This amendment provides information and guidance on nitrogen application rates for bermudagrass/ryegrass rotation pasture and hayland. This amendment is not intended to address other factors affecting stocking rate such as the effect of livestock on soil and plant health.

Computer modeling using Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) was used to predict nitrogen leaching based upon nitrogen application under various conditions. The values presented in Table FL6-6a were predicted to leach less than 10 ppm nitrate averaged over a 20 year period. This data represents maximum nitrogen application rate until research data is available.

BACKGROUND. As the result of a lack of research data on pasture grass uptake under a typical Florida dairy rotational grazing systems, FL NRCS modeled a rotational grazing system using the computer model GLEAMS. The model was used to determine proper nitrogen application rates in order to reduce nitrate leaching to groundwater. During the summer of 1992, the NRCS conducted interviews with eight dairy producers in the Middle Suwannee River Area. Data was collected on pastures, high intensity areas (HIA), barns, manure storage facilities, herd size, soils, crops grown, manure spreading methods and cooling methods. The data from the interviews was used to develop "typical" values to input into the GLEAMS computer model.

Two of the best management practices (BMPs) modeled were rotational grazing of pastures and application of dairy waste on cropland. Two different soil types were modeled for these BMPs. The first soil type consisted of a well drained soil with an average water holding capacity less than 0.1 inch per inch and a hydraulic conductivity of 3 inches per hour throughout the profile. The second soil type consisted of a heavier soil with a higher clay and silt content. This soil was modeled with a average water holding capacity of 0.2 inch per inch and had a slowly permeable layer below the root zone which a hydraulic conductivity of 0.1 inch per hour. The hydrology soil group (HSG) for these soils was an A for the first soil and a C for the second soil. Each of the BMPs were modeled under four different water management scenarios. These scenarios were as follows:

1. Intensive Management - irrigation to meet the full consumptive use demand of the bermudagrass/ryegrass crop with a well drained soil.
2. Moderate Management - irrigation is applied but does not meet the consumptive use demand during peak consumptive use periods.
3. No Irrigation Dry - no irrigation is applied to the bermudagrass/ryegrass crop with a well drained soil.

4. No Irrigation Wet - no irrigation is applied to the bermudagrass/ryegrass crop with a soil which has a high clay content for Florida soils and has a higher average water holding capacity.

A series of modeling runs was done for each of the above scenarios to determine the nitrogen application rate which would result in an average nitrate leaching rate of 10 ppm over a 20 year period. The results of the analysis showed that the no irrigation with a high water holding capacity soil could have as much nitrogen applied as the well drained soil with intensive water management. The heavier soil holds the nitrogen in the root zone longer for use by the crop. Also, more rainfall runs off the heavier soil rather than infiltrate into the soil profile which reduces water leaching through the profile.

Presented in Table FL6-6a are the maximum values which were determined to be the proper nitrogen application rates based upon the 10 ppm nitrate leaching criteria. For situations which fall between the defined categories in Table FL6-6a, the professional judgment of the engineer/planner will be required to determine the proper nitrogen application rate using the data provided above. The rate of nitrogen application used in the waste management plan shall be documented by the designer.

Table FL6-6a - Maximum Application Rates 1/ and Estimated Yields 2/

Crop Rotation		Intensive Irrigation Management and No Irrigation with Wet Soil 3/	Moderate Irrigation Management	No Irrigation with a Dry Soil 4/
Bermudagrass/ Ryegrass Rotational Grazed Pasture 3 week rotation	N lb/ac/yr	395	335	265
	P (P_2O_5) lb/ac/yr	47 (108)	40 (92)	31 (71)
	K (K_2O) lb/ac/yr	141 (169)	112 (135)	98 (118)
	Bermudagrass Yield - ton/ac/yr	3.5	3.0	2.5
	Ryegrass Yield - ton/ac/yr	1.5	1.0	1.0
Bermudagrass/ Ryegrass Hayland 6 week harvest interval	N lb/ac/yr	520	460	385
	P (P_2O_5) lb/ac/yr	60 (137)	53 (121)	44 (101)
	K (K_2O) lb/ac/yr	281 (338)	224 (270)	182 (220)
	Bermudagrass Yield - ton/ac/yr	8.5	7.0	5.5
	Ryegrass Yield - ton/ac/yr	1.5	1.0	1.0

1/ This is the total amount of N that can be applied after losses. Losses include mineralization, leaching, denitrification, and application.
2/ Based on GLEAMS computer modeling.
3/ Wet soil refers to a soil with an average water holding capacity of 0.2 inches per inch in the root zone, a hydrologic soil group C, and a restrictive layer below the root zone.
4/ Dry soil refers to a soil with an average water holding capacity of 0.1 inches per inch, a hydrologic soil group A, and no restrictive layers which would hold water within the root zone for extended periods

(g) Continuous grazing pasture systems.

A continuous grazed pasture is a pasture which does not meet the criteria for rotational grazing as described in the AWMFH Florida Amendment Chapter 9, FL651.96(a). Pastures managed as continuous grazing pastures will have lower nutrient removal rates than rotationally grazed pasture systems.

From observations, lower nutrient removal rates are due to the following:

- continuous grazed pastures tend to have waste poorly distributed within the pasture caused by uneven grazing by the animals,
- areas of the field closest to the barn or gate will likely be over grazed (and have waste over applied) and the areas furthest out in the pastures will be under utilized, and
- after just a few years of continuous grazing, improved varieties of grasses tend to be replaced by less productive common varieties (i.e. coastal bermudagrass will be replaced by common bermudagrass).

Continuous grazed dairy herd pastures should be planned for application rates consistent with IFAS SL-129. For South Florida if the pasture is bahiagrass, this document recommends 0.0 lbs. phosphorous per acre per year be applied to pastures since there is no economic return under cow/calf operations. However, since dairy pasture systems have different economic dynamics, the values for North Florida can be used (i.e., 160 lbs N/ac/yr, 40 lbs P_2O_5/ac/yr, 80 lbs K_2O/ac/yr under the High N option for bahiagrass).

These values can be adjusted as appropriate for practices such as planting cool season grasses or haying pasture fields during periods of the year when forage growth exceeds the forage requirement of the pastured animals. An agronomist should be consulted to determine the extent that the values should be adjusted based on the nutrient removed in the harvested material.

When continuous grazing pasture systems are used, management techniques should be used to prevent the development of denuded areas to the extent practicable. When denuded area cannot be prevented, runoff should be captured and treated appropriately from these areas.