

Definition and Purpose

This information sheet provides guidance for preparing the nutrient management (590) component of NRCS resource conservation plans.

Nutrient management is managing the source, rate, form, timing, and placement of nutrients. Nutrient management effectively and efficiently uses scarce nutrient resources to adequately supply soils and plants to produce food, forage, fiber, and cover while minimizing environmental degradation. Nutrient management is applicable to all lands where plant nutrients and soil amendments are applied.



Nutrient management may be a component of a conservation management system and is most effective when used in conjunction with crop rotation, residue management, pest management, conservation buffer practices, and/or other practices needed on a site-specific basis to address natural resource concerns and the landowner’s objectives.

The major role of nutrient management is to minimize nutrient losses from fields, thus helping protect surface and ground water supplies.

Nutrient management may be used to plan the safe and effective application of organic wastes (manures and by-products). However, when the organic wastes are produced by animals located onsite and the manures are stored onsite, a Comprehensive Nutrient Management Plan (CNMP) should be prepared to plan the safe and effective distribution of wastes from the onsite storage structures.

General Nutrient Management Considerations

- Test soil, plants, water and organic material for nutrient content.
- Apply nutrients according to soil test recommendations.
- Set realistic yield goals.
- Account for nutrient credits from all sources.
- Use cover and green manure crops where possible to recover and retain residual nitrogen and other nutrients between cropping periods.
- Apply nitrogen fertilizer as close as possible to the time of maximum plant uptake. Avoid fall applications of nitrogen fertilizer. Use split applications of nitrogen fertilizer for greater nutrient efficiency.

Specific Nutrient Management Considerations for Missouri (Note: Based on the current Missouri Nutrient Management [590] Standard)

For typical fertilizer recommendations:

1. A nutrient budget for nitrogen, phosphorus, and potassium shall be prepared that accounts for nutrients supplied, utilized, and residual.
 - a. Nutrients supplied—includes nutrients applied in fertilizers, manures and organic by-products, nitrogen in irrigation water, and nutrients supplied by soil. Nitrogen credits for preceding crops must be included as a supply factor in the budget.
 - b. Nutrients utilized—crop uptake, nutrients removed in the harvested portions of plants.

- c. Residual nutrients—nutrients remaining in the environment after crop harvest. These nutrients may be in the soil (associated with soil minerals or incorporated into soil organic matter) or in plant residues.
2. Nutrient recommendations shall be based on soil tests that are no more than four years old.
3. Soil tests shall be performed on composite samples from field areas that are no greater than 20 acres
 - a. Composite samples consist of 12-24 individual soil cores collected to represent the entire sampled area.
 - b. Soil samples shall be collected in accordance with guidelines published by the University of Missouri (see MU Guidesheets G9217 (Soil Sampling Hayfields and Row Crops), and G9215 (Soil Sampling Pastures)).



4. Nutrient recommendations shall be based on University of Missouri recommendations and must be provided by the University or by a laboratory on the Missouri Soil Testing Association Certified Laboratories list (see <http://soilplantlab.missouri.edu/soil/mstacertified.htm>).
5. Nutrient recommendations and nutrient budgets based on soil tests and expected yield shall be made on field areas matching the soil sampling areas, i.e., no larger than 20 acres. If recommended application rates are within 10%, the average of the 20-acre application rates may be determined and a single rate may be applied to field areas up to 80 acres. Nutrient budgets also may be based on these larger field areas. Applications and budgets for areas larger than 80 acres may be planned and applied if a justification for this decision is documented in the nutrient management plan.
6. Apply nutrients and soil amendments (lime) according to soil test recommendations. Applications shall not exceed recommended amounts by the greater of 10 lbs or 10%. Annual applications of nitrogen may not exceed recommendations; however, the amounts of phosphorus and potassium needed for multiple years in a crop rotation may be applied in one or more field operations that exceed the recommended annual amounts.
7. Records documenting the amount of fertilizer material applied to specific field areas shall be provided as well as records of applicator equipment calibrations, fertilizer formulations, methods of application, application date(s), and harvest date and yield.

For grid or zone soil samples and variable-rate phosphorus, potassium, and lime recommendations:

Follow requirements of typical nutrient applications with these additional guidelines:

1. Budgets for nutrient application and utilization must be developed, and may be based on the mean of soil test recommendations for a specified field area. Field areas for budgeting purposes may be up to 80 acres. Budgets for areas larger than 80 acres may be developed when a justification for this decision is included in the nutrient management plan.
2. Nutrient recommendations for grid and zone soil samples shall be based on soil tests that are no more than four years old.

3. Soil tests shall be performed on soil samples that represent no more than 3 acres, or from sampling zones smaller than 20 acres that were identified prior to soil sampling using any combination of remote sensing, soil and/or crop condition sensing, or yield maps.
4. Individual grid soil samples shall consist of no fewer than 8 individual soil cores collected from an area of approximately 30-ft diameter surrounding the grid sample point. Zone soil sampling shall be based on 1-2 cores/acre with a sampling intensity of 12-24 cores for a 20-acre field area.
5. Records documenting the amount of fertilizer material applied to specified field areas shall be provided in the form of dated as-applied maps.

Variable-rate application of nitrogen requires special procedures that are described in Agronomy Technical Note No. 35

(<http://www.mo.nrcs.usda.gov/technical/agronomy/out/Agronomy%20Technical%20Note%20MO-35.pdf>)

Guidelines for Operation and Maintenance

1. Review nutrient management component of the conservation plan regularly (recommended annually) and make adjustments when needed. As a minimum the nutrient management component must be reviewed and adjusted
2. Calibrate application equipment to ensure uniform distribution and accurate application rates.
3. Protect nutrient storage areas from weather to minimize runoff and leakage.
4. Avoid unnecessary exposure to fertilizer and organic waste, and wear protective clothing when necessary.
5. Observe setbacks required for manure and organic by-product applications adjacent to waterbodies, drainageways, losing streams, and wells (both in-use and abandoned).
6. Maintain records of nutrient application as required by state and local regulations.
7. Clean up residual material from equipment and dispose of properly.

Checklist of Required Elements for Nutrient Management Planning

Nutrient management components of the conservation plan will include the following information:

- Results of soil tests
- Manure tests when applied
- Budget of nutrients applied and utilized
- Recommended rates, methods of application, form, and time of nutrient and lime application
- Total quantity applied
- Crop rotation or sequence
- Expected yield and source of estimated yield
- Actions to protect sensitive areas (setbacks)
- Field map and soil map
- Guidelines for operation and maintenance

Preparing Nutrient Management Components of Conservation Plans

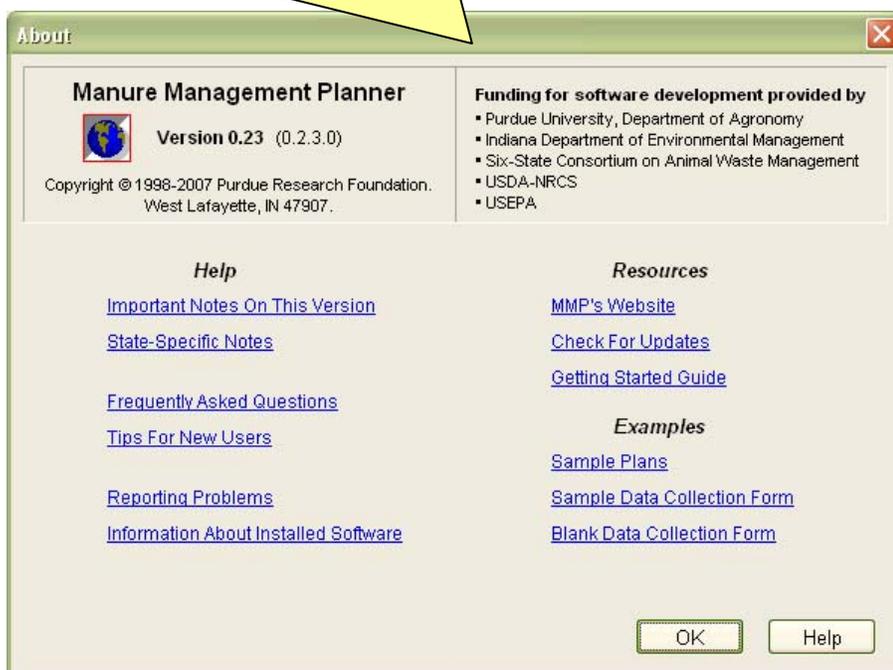
Missouri NRCS does not require a specific format for preparing nutrient management components of conservation plans. However, Missouri NRCS has provided two procedures for developing nutrient management information: a paper-based fill-in form and a software approach that uses a free, widely distributed software tool to simplify the planning process.

Planners who choose to use a format other than that provided by the paper-based form or the software tool described here should refer to the Checklist of Required Elements for the Nutrient Management Component (provided in this Information Sheet) for specific deliverable items.

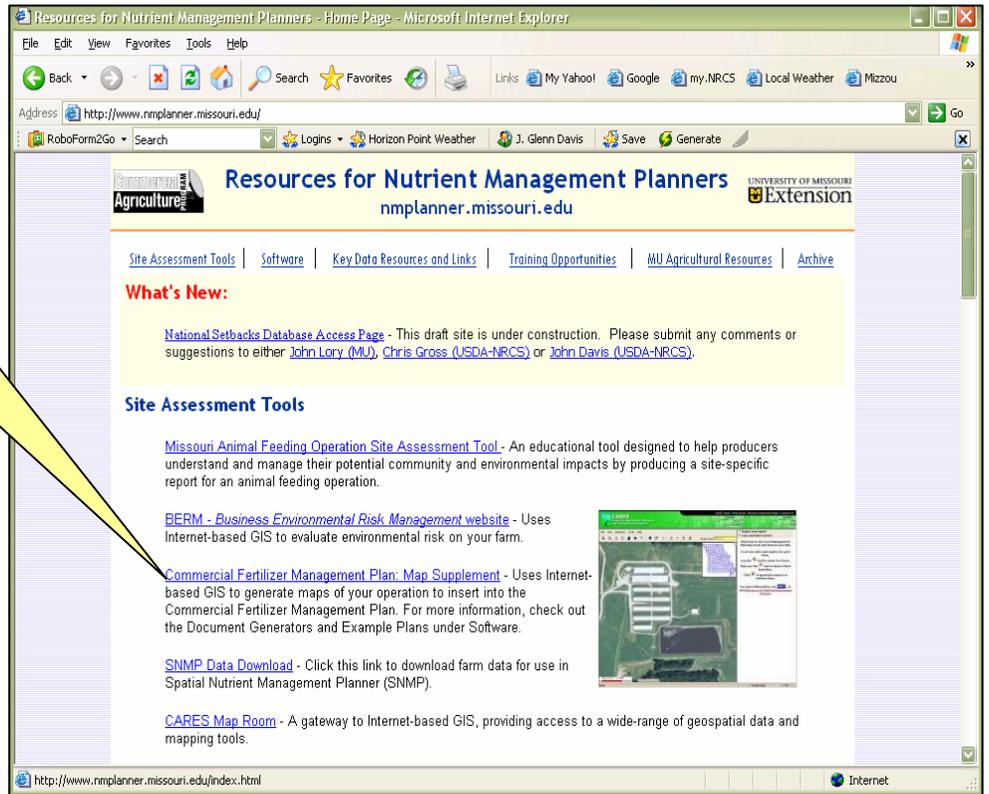
A **fill-in form** based on the Missouri NRCS Nutrient Management (590) Job Sheet can be found at <http://www.mo.nrcs.usda.gov/technical/forms/agronomy.html>. This is a paper-based form that can be downloaded and printed out for filling.

NRCS-Approved Software tools can streamline the process of preparing nutrient management specifications to meet requirements of the Missouri NRCS Nutrient Management Standard (590). The recommended plan development tool is *Manure Management Planner* (MMP) and associated report generators. A convenient location to find these tools is provided by the University of Missouri at <http://nmplanner.missouri.edu>. All components can be downloaded free of cost and are updated regularly to reflect current nutrient management policy. Important steps in this approach are shown on the following pages.

Purpose (check all that apply)					
<input type="checkbox"/> Budget and supply nutrients for plant production	<input type="checkbox"/> Utilize manure/organic material as a nutrient source				
<input type="checkbox"/> Minimize agricultural nonpoint source pollution (water quality)	<input type="checkbox"/> Maintain or improve soil condition				
Table 1 Field Conditions and Recommendations					
Crop sequence/rotation (circle current crop)					Expected yield
Current soil test levels (ppm or lb/ac)					
N	P	K	pH	S.O.M.%	EC
Recommended nutrients/amendments to meet expected yield					
N	P ₂ O ₅	K ₂ O	Lime	Other	Other
Table 2 Nutrient Sources					
Credits		N	P ₂ O ₅		K ₂ O
			Pounds per acre		
1.	Nitrogen credits from previous legume crop				
2.	Residual from long-term manure application				
3.	Irrigation water				
4.	Other (e.g., atmospheric deposition)				
5.	Total credits				
Plant available nutrients applied to field		N	P ₂ O ₅		K ₂ O
(Circle column that is landowner's decision)		Trial A	Trial B	Trial A	Trial B
6.	Credits (from row 5, above)				
7.	Fertilizer				
	Starter				
	Other				
8.	Manure/organic material				
9.	Subtotal (sum of lines 6, 7, and 8)				
10.	Nutrients recommended (from table 1)				
11.	Nutrient status (subtract line 10 from line 9)				
<small>If line 11 is a negative number, this is the amount of additional nutrients needed to meet the crop recommendation.</small>					
<small>If line 11 is a positive number, this is the amount by which the available nutrients exceed the crop requirements.</small>					
Nutrient Management Specifications					
Amount to be applied (lb/ac)	N	P ₂ O ₅	K ₂ O		
Method, form, and timing of application:					



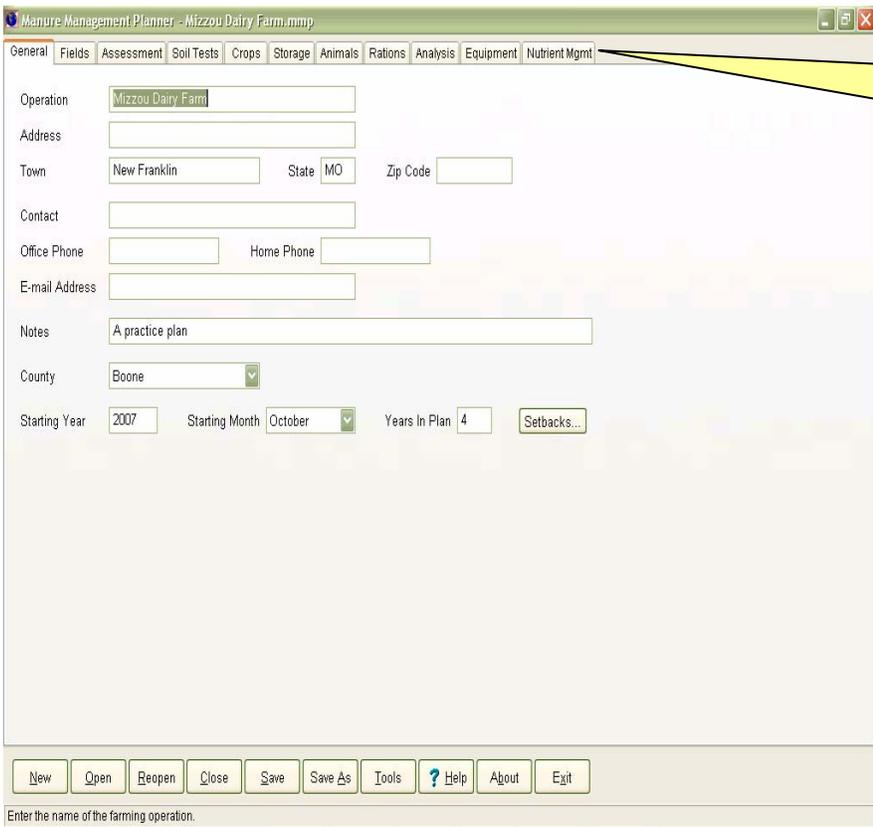
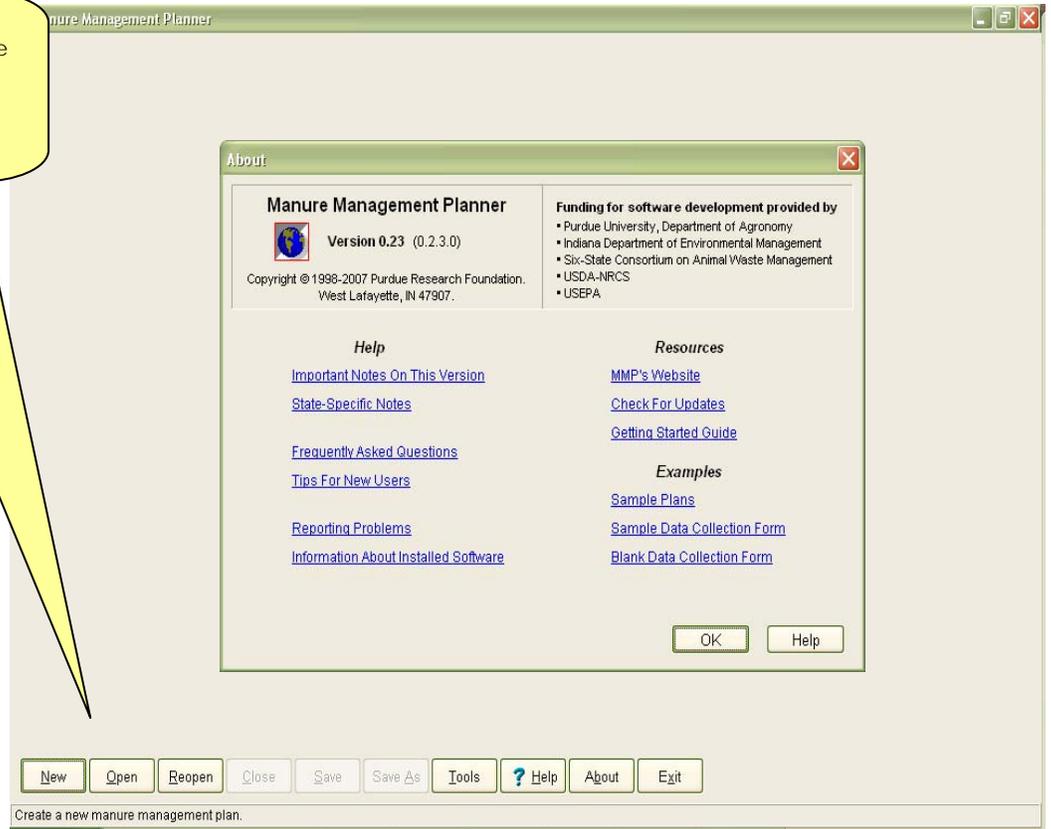
Use the Commercial Fertilizer Management Plan: Map Supplement tool to download aerial photos, soil maps and descriptions, topographic maps, and driving directions for the site.



Need further instruction on using the Map Supplement Tool? Go to <http://ims.missouri.edu/docgenmaps/Web-DocGen.html> for a slide demonstration.



Open up Manure Management Planner (MMP). Select a "New" file or open up an existing MMP file.



Here is an example file. Note the tabs along the top of the MMP window. These tabs will help guide you as you enter data.

On the "Fields" tab, enter a Field ID, size, and the predominate soil type (acreage-wise). You will have to do this by eye from the maps supplied by the Map Supplement tool.

Field ID	Subfield ID	Total Size (Acres)	Spreadable Size (Acres)	Storage Distance (Miles)	Predominant Soil Type (Name, Texture, Map Symbol, Slope Range)	Slope % (If Not Ave.)	Irrigated With Water	Is Not Owned	Farm ID	FSA Farm Number	FSA Tract Number
Field 1-CSGF		36			Ansburg SIL (60011 3-6%)						
Field 2-CSGH		38			Ansburg SIL (60011 3-6%)						
Field 3-CSGH		14			Ansburg SIL (60011 3-6%)						
Field 4-CSb		13			Weller SIL (60028 5-9%)						
Field 5-CSb		19			Ansburg SIL (60010 1-3%)						
Field 6-SbC		22			Weller SIL (60028 5-9%)						

On the "Soil Test" tab, enter the soil test information from the lab analysis sheets. One note: Missouri uses an estimate of CEC. You enter the soil test salt pH in the "Soil pH" column, and enter the Neutralizable Acidity in the "Buffer pH" column. If you enter a CEC value, it will override the "Estimated CEC" value.

Field ID	Subfield ID	Test Year	OM (%)	P	P Test Used	K	Mg	Ca	Na	Al	Levels Are in Lb/A	Soil pH	Buffer pH	Estimated CEC	CEC	NO3-N (ppm)
Field 1-CSGP		2005	2	46	Bray P1	452	222	2,820			✓	6.3	1.2	9.8	9.8	
Field 2-CSGH		2005	2.3	35	Bray P1	452	168	2,820			✓	6.2	1.9	10.2	10.2	
Field 3-CSGH		2005	2.1	38	Bray P1	350	242	2,290			✓	6	2.8	10	10	
Field 4-CSb		2005	2.3	26	Bray P1	316	234	2,642			✓	5.8	1.9	9.9	9.9	
Field 5-CSb		2005	2.1	30	Bray P1	278	174	2,422			✓	6.4	2.9	10	10	
Field 6-SbC		2005	1.9	15	Bray P1	292	212	2,694			✓	5.8	1.8	9.8	9.8	

On the "Crops" tab, enter the intended crop from the pull-down list in the row corresponding to the correct field and year. Also enter the realistic yield goal. A default recommendation for NPK will be provided; this is the MU recommendation. You can override these recommendations in the "Custom" recs columns—but provide a justification for your decision. Double-crop situations can be planned also.

Field ID	Subfield ID	Crop Year	Planned Crop (Or Second Crop If Double Cropping)	Yield Goal (Acres)	Yield Units	Legume % Stand	Default N Rec (Lb/A)	Default P205 Rec (Lb/A)	Default K20 Rec (Lb/A)	Custom N Rec (Lb/A)	Custom P205 Rec (Lb/A)	Custom K20 Rec (Lb/A)	Source Of
Field 1-CSGP		2008	Cool season grass pasture	3	Ton		120	5	0				
Field 1-CSGP		2009	Cool season grass pasture	3	Ton		120	5	0				
Field 1-CSGP		2010	Cool season grass pasture	3	Ton		120	5	0				
Field 1-CSGP		2011	Cool season grass pasture	3	Ton		120	5	0				
Field 2-CSGH		2008	Cool season grass hay	3	Ton		120	35	0				
Field 2-CSGH		2009	Cool season grass hay	3	Ton		120	35	0				
Field 2-CSGH		2010	Cool season grass hay	3	Ton		120	35	0				
Field 2-CSGH		2011	Cool season grass hay	3	Ton		120	35	0				
Field 3-CSGH		2008	Cool season grass hay	3	Ton		120	30	0				
Field 3-CSGH		2009	Cool season grass hay	3	Ton		120	30	0				
Field 3-CSGH		2010	Cool season grass hay	3	Ton		120	30	0				
Field 3-CSGH		2011	Cool season grass hay	3	Ton		120	30	0				
Field 4-CSb		2008	Corn grain	160	Bu		140	95	30				
Field 4-CSb		2009	Soybeans	40	Bu		0	55	40				
Field 4-CSb		2010	Corn grain	160	Bu		140	95	30				
Field 4-CSb		2011	Soybeans	40	Bu		0	55	40				
Field 5-CSb		2008	Corn grain	160	Bu		140	90	45				
Field 5-CSb		2009	Soybeans	40	Bu		0	50	55				
Field 5-CSb		2010	Corn grain	160	Bu		140	90	45				
Field 5-CSb		2011	Soybeans	40	Bu		0	50	55				

For commercial fertilizer applications (no manure) you can ignore the "Storage", "Animals", "Rations", "Analysis", and "Equipment" tabs.

1. Click on the "Nutrient Mgmt" tab.

Plan Month:	Oct 2007	Nov 2007	Dec 2007	Jan 2008	Feb 2008	Mar 2008	Apr 2008	May 2008	Jun 2008	Jul 2008	Aug 2008	Sep 2008
Field 1-CSGP					F							
Field 2-CSGH					F							
Field 3-CSGH					F							
Field 4-CSb						F						
Field 5-CSb						F						
Field 6-SbC						F						

2. Double-click on the cell corresponding to the month, year, and field in which you want to make a commercial fertilizer application. (The "F" designates a fertilizer application)

Fertilizer Application Editor

Field: Field 1-CSGP Month: Feb 2008 Crop: Cool season grass pasture

Nutrient Status (Lb/A): N Rec: 0, P205 Rec: -5, K20 Rec: 0, P205 Rem: -9, K20 Rem: -34

Field/Spreadable Area: 46-0-0 @ 260 Lb/A Supplies 120 Lb N, 0 Lb P205, 0 Lb K20

N: 46 % P205: 0 % K20: 0 % Form: Dry

Rate: 260 Lb/A Method: Surface broadcast

Include Fertilizer When Calculating Field's Manure Application Rate

Apply Fertilizer To: Entire Field Spreadable Area Non-Spreadable Area

Notes: [Empty text box]

Buttons: New..., Duplicate..., Delete, Close, Help

3. The "Fertilizer Application Editor opens up. By selecting a "New" application, you will be able to add fertilizer based on an analysis (%NPK) or a specific amount of NPK in lb/acre. You can add "blends" of one or more fertilizer materials. You must specify the form of fertilizer and the method of application. Further instructions for use of the "Fertilizer Application Editor" can be found at http://www.cares.missouri.edu/snmp/mmp_tuts.htm and look for Tutorial 7 on either the Poultry or Swine MMP Tutorials.

For commercial fertilizer applications (no manure) you can ignore the "Storage", "Animals", "Rations", "Analysis", and "Equipment" tabs.

Generate reports for documentation using the Missouri Commercial Fertilizer Document Generator in the Tools | Custom tab.

Decide whether you wish to print out a complete plan (Missouri Fertilizer NMP – Farm Information Summary), or simplified yearly farmer guidance documents (Missouri Fertilizer NMP – Yearly Farmer Plan).

The screenshot shows the 'Manure Management Planner - Mizzou Dairy Fa' application window. The 'Tools' dialog box is open, displaying the 'Custom' tab. The dialog contains a list of tools with expandable icons and counts:

- Charts Of Planned Manure Applications [5]
- Manure Application Planning Calendars [3]
- Manure Application Recordkeeping Tool (MA [2]
- Missouri CNMP Document Generator [2]
- Missouri Commercial Fertilizer Document Generator [2]
- Missouri Fertilizer NMP - Farm Information Summary
- Missouri Fertilizer NMP - Yearly Farmer Plan
- MO Commercial Fertilizer NMP Document Generator v. 1.08 [3]
- National USDA-NRCS Format Document Maker [42]
- RUSLE2 Link [1]

Below the list, there are input fields for 'Source' (set to 'Manure Management Planner') and 'Requires'. A 'Run Custom Tool' button is present, along with 'Cancel' and 'Help' buttons at the bottom.

The background application window shows tabs for 'General', 'Fields', 'Assessment', 'Soil Tests', 'Crops', 'Rations', 'Analysis', 'Equipment', and 'Nutrient Mgmt'. The 'Nutrient Mgmt' tab is active, showing a calendar for 'Feb 2008' and a list of fields including 'Field 3-CSGH'.

If you would like to view an example report using these document generators, follow [this link](http://www.mo.nrcs.usda.gov/technical/nut_mgmt_index.html) (http://www.mo.nrcs.usda.gov/technical/nut_mgmt_index.html) to view an example report created using the Commercial Fertilizer Templates in MMP.