WHOLE FARM NUTRIENT BALANCE CALCULATOR

TUTORIAL WORKBOOK-*TEACHING GUIDE*

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Nutrient Management Spear Program

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Contents

Teaching Goals

This section of the teaching module follows the Whole Farm Nutrient Balance Calculator; Tutorial Workbook and is designed to be compatible with a 1-hour computer laboratory exercise in which the whole class follows along together with an overhead projected version of the Whole Farm Nutrient Balance Calculator.

The purposes of this segment of the curriculum are two-fold:

(1) To reinforce concepts associated with nutrient mass balance analyses presented in lecture, by reading through extension fact sheets and answering question independently or through group discussions.
(2) Become familiar with the "look and feel" of the tool/software by adding data and the functionality of the software by actually interacting with it.

Completing this section of the curriculum after the lecture solidifies concepts presented in lecture by providing the same information in multiple learning formats. It also engages the use of professional reference tools (fact sheets and software), which provides experiences and skills that are immediately applicable for crop and farm advisors or managers.

Materials used for this section of the curriculum are:

(1) Software – Whole Farm Nutrient Balance Calculator
(2) Whole Farm Nutrient Balance Calculator Tutorial Workbook.

The tutorial for the Whole Farm Nutrient Balance calculator takes the users through a step by step set of data entry, questions and evaluation exercises using the Whole Farm Nutrient Balance Calculator. This Teaching Guide offers guidance on discussion points for each section.

This tutorial walks the user through the input of the needed data and the tools used to generate the mass balance reports. For this tutorial we will look at the imaginary small herd of Jersey cattle and goats owned by Mr. Joe Deere.

The tutorial begins with downloading and opening the Whole Farm Nutrient Balance Calculator on each student's desktop which requires an internet connection. If an internet connection is unavailable in the classroom, the calculator can be downloaded on a computer that does have internet access, and then transferred to class computers using a portable drive or disk.

It is recommended that no more than two people share a computer for optimal learning.

Introduction

The Mass Nutrient Balance Calculator is a tool developed by Cornell University's Nutrient Management Spear Program in an effort to educate farmers and nutrient management planners of potential discrepancies between nutrient input and output on farms. The program accounts for common sources of nutrient imports (feed, fertilizer, animals, etc.) and exports (animals or products sold, manure or other wastes, crops sold, etc.), using farm data to generate an overall summary of the nutrient balance on the farm.

Producers can obtain a list of the needed information on Cornell's Nutrient Management Spear Program website: http://nmsp.cals.cornell.edu/projects/massbalance.html. The "input data sheets" form found on this page details all the information needed, allowing easy input into the program at a later time. The software can be downloaded from the same website.

To determine the nutrient balances, the amounts of nutrient sources and exports need to be determined. Just as important are the nutrient analyses and total amounts of feed, fertilizer, bedding, and manure. The accuracy and reliability of the mass nutrient balance is dependent on the accuracy and quality of the inputs.

Nutrient Balance Program Overview

Teaching Guide: *Overview of NMB data function and data requirements.*

Before getting started with the calculator, take some time to get an overview of the nutrient mass balance by reading Agronomy Fact Sheet 25 which can be found in the Appendix:

- *Agronomy Fact Sheet #25: Mass Nutrient Balance Software.*

Now answer the following question:

Question (1):

- What does the Mass Nutrient Balance calculate?

Answer (1):

- Calculates the amount of nutrients (N, P and K) being imported to the farm in the form of purchased feeds (i.e. not homegrown), fertilizers, animals, and bedding material.
- Calculates the amount of nutrients being exported (N, P, K) from the farm in the form of products sold including, feed, milk, animals, crops, and manure/compost.
- Calculates the difference between the nutrients (N, P and K) imported and exported.

Nutrient Balance Program Data Requirements

Teaching Guide: *Overview of NMB data function and data requirements. Getting accurate calculations from this calculator will depend on entering accurate farm-specific data.*

Determine what farm data will need to be assembled by reviewing the Input Data Form Instructions and Input Data Form which can be found in the Appendix.

- *Mass Nutrient Balance Input Form Instructions*
- *Mass Nutrient Balance Input Form*

Now answer the following question:

Question (2):

- List four typical dairy farm nutrient imports and four typical dairy farm exports.

Answer (2):

- Imports: 1) purchased feed; 2) purchased fertilizer; 3) purchased livestock; 4) purchased bedding.
- Exports: 1) milk sold; 2) livestock sold; 3) crops sold; 4) manure or compost exported.

Using the Program

Teaching Guide: *Take-home message: keeping data/information organized helps to ensure the necessary information is accessible and can easily be used to derive a farm balance and give guidance on nutrient management.*

Action 1: Open the calculator and click on the contact button. Fill in the information as follows. Enter the information shown below:

Contact information	
Producer name	Joe Deere
Farm name	Joe's Jerseys
Address	1 JD Lane
City, state, zip	Somewhere, NY 00000
Phone	000 000 0000
E-mail	jd@jj.com

Farm information

The balance year determines the calendar year (January to December) for which the data are being entered. Entering information over time allows producers to track their nutrient balances and evaluate the success of new programs or management changes. The total farm acres are needed to calculate yields and land area over which manure or fertilizers are spread.

Action 2: Enter the following information:

Farm Information	
Balance year	2008
Total farm acres	100
All tillable crop and pasture acres	75
# acres, perennial and annual with > 10% legume	30
Acres receiving manure	50

Watershed

Most farms are only located in one watershed. Enter the primary (and secondary, if applicable) watershed in which the farm resides. This allows for watershed specific end-of-year farm summaries to be compiled.

Action 3: Enter the following information:

Watershed	
Primary	Genesee River
Secondary	None

Animal Information

This section is only applicable to livestock farmers and can be ignored by crop farmers. Simply leave "0" in the fields when working with a crop farm. For those with livestock, enter the number of cattle by category, including an average weight. As animal numbers may vary throughout the year, an average population size should be used. This helps to calculate the amount of manure produced during the year. The total animal units (AU) are calculated and listed below the input fields.

Action 4: Enter the following information:

Animal information		
	# of animals	Weight (lbs)
Milking and dry cows	50	1100
Heifers: 1-2 year	10	700
Heifers < 1 year	0	0
Calves	15	200
Bulls and steers	10	1000
Other livestock (goats)	10	120

Question (3):

- What is the "total animal units" value and how is it calculated?

Answer (3):

- Joe Jersey has 76.2 animal units. An animal unit is equal to 1,000 lbs live weight. The total animal units are the combined weight (lbs) of all animals divided by 1,000.

Other Information

Also included are some yes/no questions pertaining to various farm summaries and production info. These are not used by the program, but merely serve as an indicator of records kept by the farm. Check the appropriate fields.

Action 5: Enter the following information:

Other information	
Cornell Dairy Farm Business Summary (DFBS)	Yes
Intensive grazing	Yes
All others	No

Once you have entered the information, the Contact Screen should look like Figure 1.

Action 6: Once all the information is entered, select "Next" at the top of the screen.

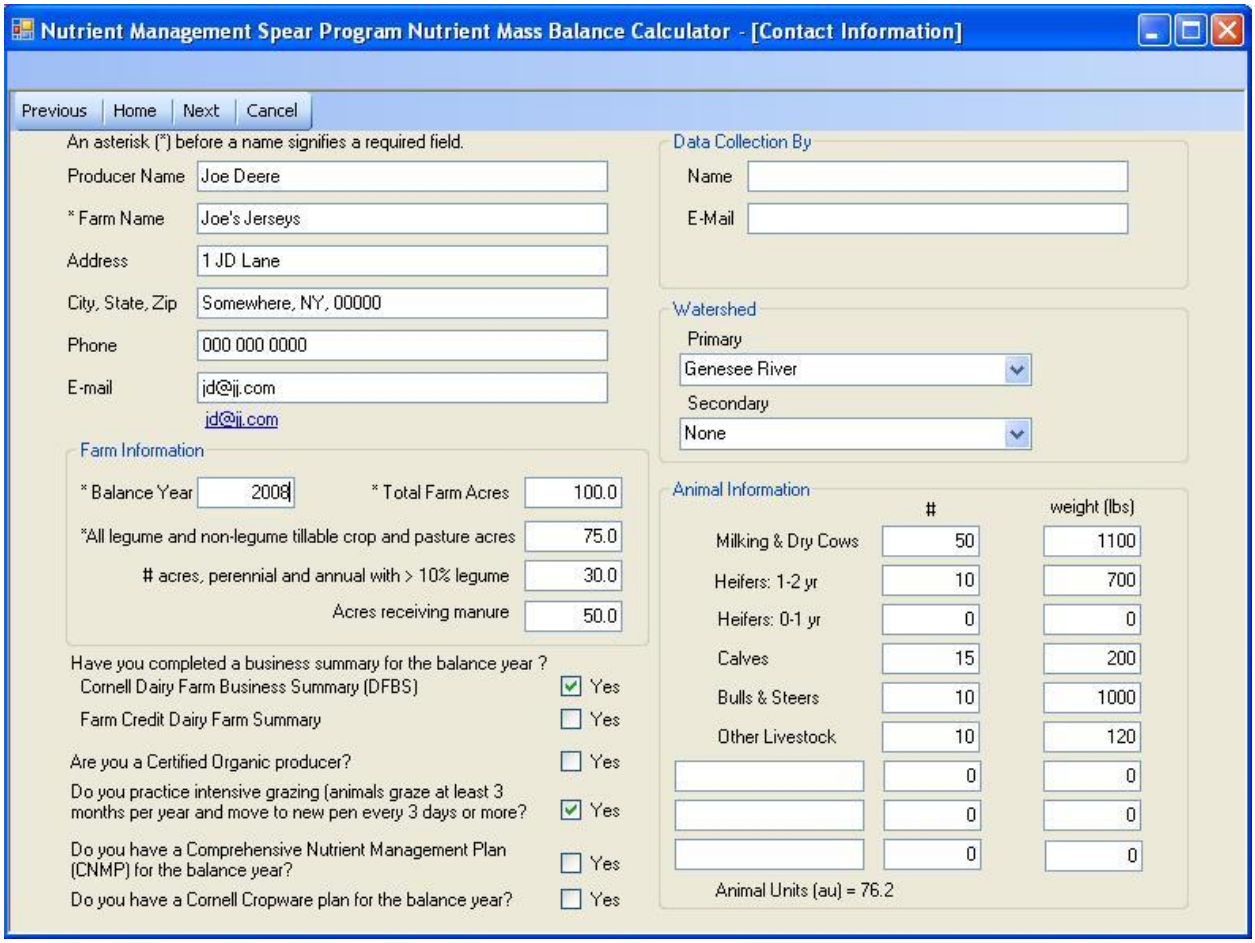


Figure 1: After adding the data listed above the Contact Screen will include contact, farm, watershed, animal and additional farm characteristic information.

Enter Farm Crop Production

Teaching Guide: *Accurate farm crop production records are important to an accurate nutrient balance analysis. Determining farm crop yields may be especially difficult.*

Enter in relevant information for all crops grown and harvested on the farm, including those used for pasture and bedding. Several types of crops and average nutrient analyses are already programmed into the calculator, and appear in a list on the right-hand side of the screen. Double-clicking one of these will put it on your list. From there, adjustments can be made to the nutrient values.

- Yield and Inventory Entered as: select the appropriate response. If "As Fed" is selected, you will need to enter the % Dry Matter in a later column. The yield and inventory values must all be entered in DM or AF, whichever you chose.
- Inventories: these track the "carryover" of nutrients from one year to the next and ensure that nutrients in things like stored feed are accounted for properly when dealing with

multiple years of data. The ending inventory values can be used to automatically update the next year's starting inventory. For the Farm Crop Production table, these values must be in DM.

Note that in these entry fields, and all others, the entire row of information must be completed before you can go back to correct a mistake or change a value. If you either add a crop accidentally or otherwise wish to get rid of one from the chart, highlight the row by clicking the panel to the left of the Crop column and then clicking "Delete Current Row" at the top of the screen. Select "Okay" to confirm the deletion.

Action 7: Enter the following information:

Crop	Legume	Acre	Manure applied	CP	P	K	Feed type	Yield & inventory	DM	Yield	Beg. Inv.	End. Inv.
	%			%DM					%	(t/a)	(tons)	(tons)
Dry Hay	20	20	No	16	0.32	2.3	Forage	Dry	n/a	2.2	0	0
Corn Silage	0	20	No	9	0.21	0.95	Forage	As Fed	30	15	20	20

Question (4):

- If Joe did not know his corn silage yield, how could he go about estimating it?

Answer (4):

- The objective is to determine the quantity of crop harvested. Since Joe did not sell any corn silage, the quantity harvested =

  [Beginning inventory + (daily feed out * number of days since harvest) – current inventory] * [1+ shrink %, in decimal form).

  Harvested Yield = Quantity harvested / Acres harvested

- Joe should initiate a system to track yield for next year.

Question (5):

- Where would Joe find his corn silage crude protein, P and K?

Answer (5):

- Joe should have a forage analysis done to determine crude protein, P and K. On the forage analysis sheet, be sure to use the values under the "Dry Matter Basis" column. If he does not have a forage analysis, there are "book" values on the right hand side of the crop production screen.

Once you have entered the information, the Crop Production screen should look like Figure 2.

Action 8: Once all the information is entered, select "Next" at the top of the screen.

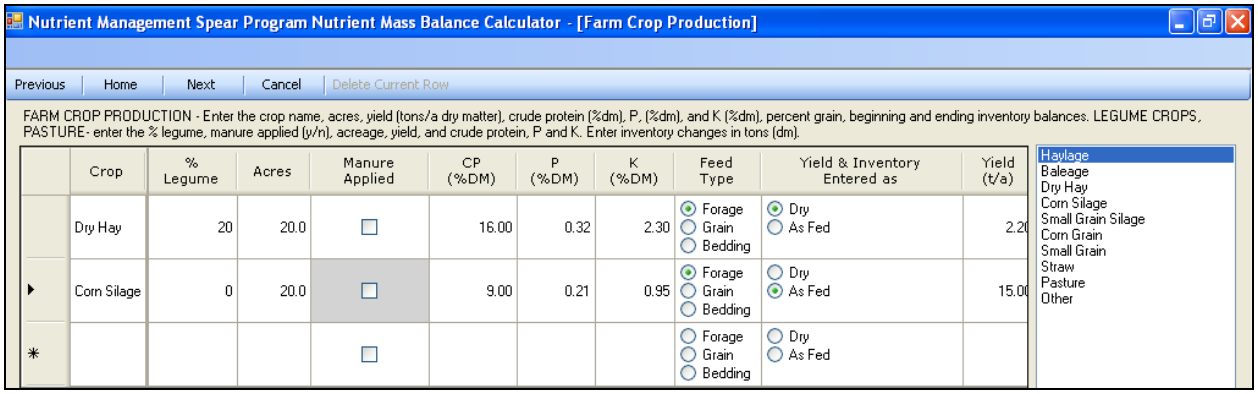


Figure 2. Farm crop production screen. Note that the "manure applied" box only is accessible for fields with legume content >0%. The pre-made crop types are on the right-hand side of the page.

Enter Farm Imports

Teaching Guide: *Recording the quantity purchased, as well as the dollar amount spent, will provide accurate values for the mass nutrient balance analysis.*

The imports pages tabulate nutrient sources, like animal feed, fertilizer, and livestock, which are imported to your farm – i.e. they were brought onto the farm and not generated on-farm as would be the case for homegrown feeds or previously-acquired animals.

Purchased Feed

Here you can enter various purchased products used in livestock rations. As with the crop screen, there are already a series of pre-entered common feedstuffs for easy use.

- % Forage: for total mixed rations (TMRs); this value is used to calculate how much forage is brought in for the mix. The program assumes that all of the TMR (forage and concentrate portions) are purchased. If you grow forage that gets added to purchased concentrates to form a TMR, enter the concentrate values here, as the forage component is included on the Farm Crops page.
- Inventories: allow tracking of starting and ending supplies of feeds (in tons as-fed so wet tons)

Action 9: Enter the following information.

Item	Tons per year	DM	CP	P	K	Feed type	Forage	Beg. Inv.	End Inv.
		%	% DM				%	(wet tons)	
Soybean Meal 44	10	90	49.9	0.71	2.22	Grain	n/a	0.5	2.5
Brewers Grain-Wet	15	25	26	0.7	0.58	Grain	n/a	1	3

Action 10: Once all the information is entered, select "Next" at the top of the screen.

Fertilizers Purchased

Here enter the amount and analyses of all fertilizers used on the farm. Note that, unlike the feed and crop pages, there are no columns for beginning and ending inventories. Thus you should only enter the amount of fertilizer actually spread, and not include any bought but not used. Like the previous pages, there are pre-made fertilizers that can be quickly put into the chart.

Action 11: Record 15 tons of 10-20-20 as the amount of fertilizer purchased.

Action 12: Once all the information is entered, select "Next" at the top of the screen.

Animals Purchased

Any animals purchased during the year should be put into this page, including replacement heifers, bulls, etc. Use the dropdown menu on the left to select a species, add a description, and then input the number and average weight of the animals.

Action 13: Enter the following information.

Animals Purchased			
Type	Description	Number	Weight per head (lbs)
Goats	Buck	1	150
Dairy	Replacement heifers	3	800

Action 14: Once all the information is entered, select "Next" at the top of the screen.

Once you have entered the information, the Animal Imports Screen should look like Figure 3.

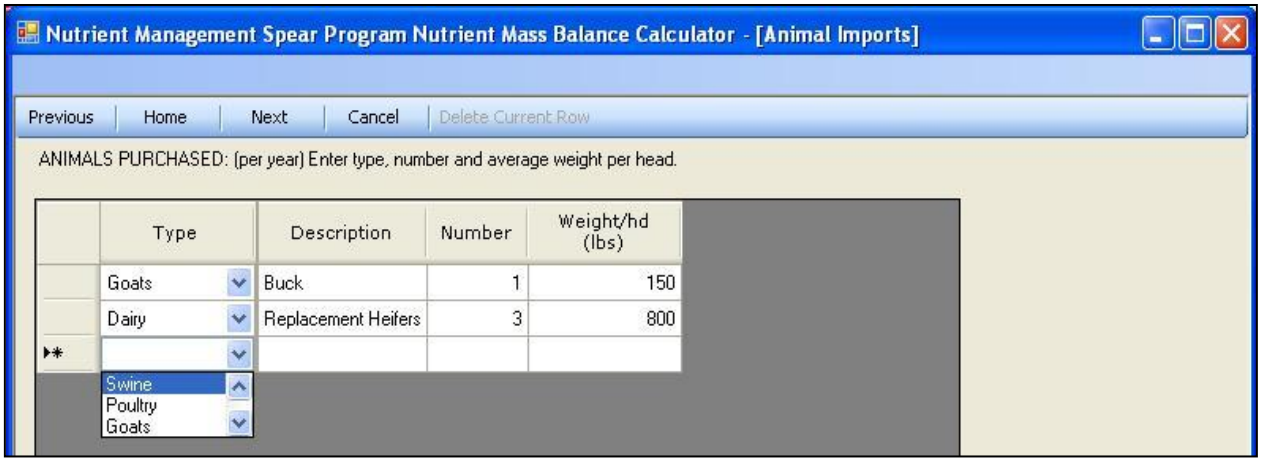


Figure 3. Animal imports screen.

Bedding and Miscellaneous Imports

Enter other sources of nutrient imports, including bedding. However, bedding produced on the farm should not be included in this section. As in earlier screens, there are some pre-made inputs for bedding varieties. Unless you test your own bedding, it is best to use these pre-made values.

Action 15: Enter the following information:

Bedding and Miscellaneous Imports					
Item	Tons/yr	% DM	N (% DM)	P (% DM)	K (% DM)
Wheat Straw	15	92.7	0.77	0.1	1.55

Action 16: Once all the information is entered, select "Next" at the top of the screen.

Question (6):

- Where would you find crude protein, P and K composition of a custom feed blend?

Answer (6):

- The nutrient composition of purchased feeds is commonly on the bag or on a sheet provided with deliver of bulk feeds. The farm nutritionist or the mill providing the feed can also provide the CP, P and K composition of the feed.

Enter Farm Exports

Teaching Guide: *Recording the quantity sold, as well as the dollar amount received, will provide accurate values for the mass nutrient balance analysis. Through the year record the weight as well as the number of animals sold.*

The export pages account for nutrients produced on-farm that leave – things like manure, milk, and sold livestock and crops.

Milk Sold

Enter the pounds of milk sold and the % Milk Protein, as listed on milk checks. Make sure that the pounds produced per head looks reasonable. If not, you may want to double check on the average herd size entered in the Contacts page.

Action 17: Select Milk Sold screen and enter 750,000 lb milk at 3.30% protein.

Action 18: Once all the information is entered, select "Next" at the top of the screen.

Animals Exports

Here enter any animals sold throughout the year, including breeding stock, cull or beef cows, etc. This also includes stock that die and are composted or rendered off-farm – do not include animals you compost yourself.

Action 19: Select Animal Exports screen and enter:

Animal Exports			
Type	Description	Number	Weight/head (lbs)
Goats	Does	2	120
Dairy	Cull cows	4	1050
Dairy	Feeder calves	15	350

Action 20: Once all the information is entered, select "Next" at the top of the screen.

Crops Sold
Enter any crops, including hay and forage or grains, which were grown on the farm and sold (not fed on-farm). The information required is similar to that for earlier crop pages.

Action 21: Select Crop Exports screen and enter:

Crop Exports					
Crop	Wet tons/yr	% DM	CP (% DM)	P (% DM)	K (% DM)
Dry hay	3	20	16	0.32	2.3

Action 22: Once all the information is entered, select "Next" at the top of the screen.

Manure, Compost, and Other Exports
Here enter any manure or compost that is produced on the farm but sent elsewhere. This does not include manure, compost or sludge, etc. that are spread on the field of the farm itself. Note that the nutrient analysis columns ask for nutrient values in % wet rather than % DM, as this is how manure nutrient reports are often presented on the manure analyses.

For the purpose of this tutorial, no nutrients were exported.

Action 23: Select "Next" at the top of the screen.

Question (7):
- How would you enter the data for a farm that sends all heifers off of the farm at 300 lbs and brings them back at 1000 lbs? No farm feeds are fed to off-site animals and manure from off-site animals is not applied to farm fields.

Answer (7):
- Enter the number of heifers sent off the farm at 300 lbs as animals exported. Enter the number of heifers coming onto the farm at 1000 lbs as animals imported.
- Make sure the animal numbers on the Contact screen represents the number and weight of animals on the farm and does include animals that are housed off-site.

Generating Reports and Balances

Teaching Guide: *Use the program reports to analyze farm nutrient balance performance.*

After clicking "Next" after the final page, you will return to the "Contact" screen. From here, select "Home" at the top of the screen to return to the overall map screen from which you started. Now, the other buttons should be highlighted, enabling you to click on any of them (figure 4). You can navigate to any of the various import or export pages and change values if needed.

Once all the required information is entered into the program, you may determine the overall Mass Nutrient Balance of the farm.

Action 14: Select "Balance Reports" from the bottom of the main screen to move to the report summary page.

There are five reports that may be viewed and printed. They can be viewed individually by clicking on the box to the left of the report name, and then selecting "View Report," or by clicking "Select All" and then "View Report" a multi-tab summary report will be generated.

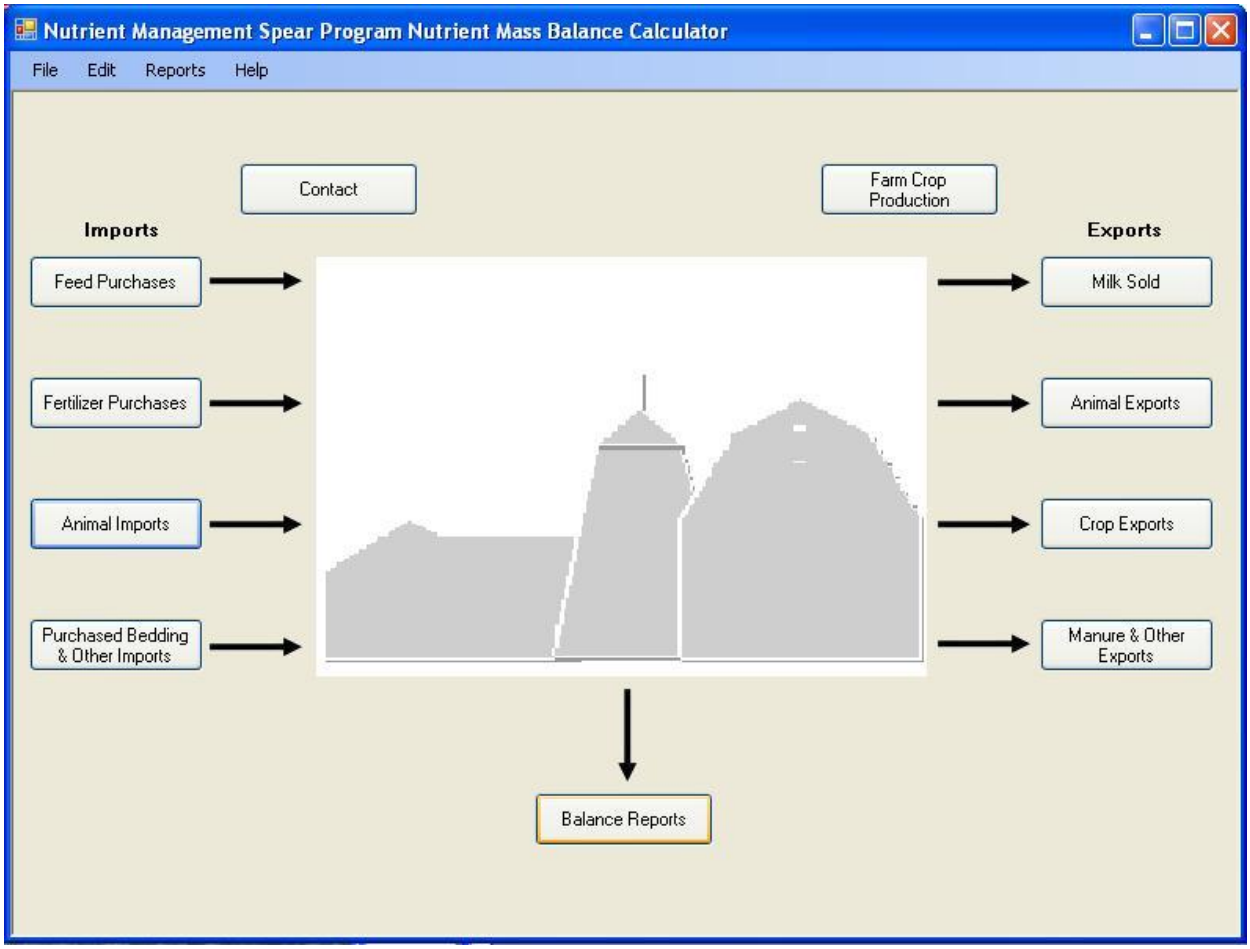


Figure 4. Home screen after information has been filled out. Now all the buttons are activated.

When printing reports, particularly the Annual Mass Nutrient Summary, print sideways on the page (landscape view). When looking at the report, select "Print Preview" on the top of the screen, and then select the landscape view button (third from the left) on the preview page. After viewing a report, the program will save a copy of it. The location of the copy will be displayed below the report's name on the Select Reports screen.

Annual Mass Nutrient Summary

This report totals all the N, P, and K imported and exported by category (for inputs – feed, fertilizer, animals, and misc; for exports – milk, animals, crops, and misc). The statistics themselves are displayed three ways, and the balance (imports – exports) is calculated (figure 5).

Output

- Tons per year: simply gives the absolute amount (in tons) of the given nutrient imported or exported. Note that in the bottom row, the nutrient difference, Joe has imported only 0.11 tons more N than he has exported – indicating a near zero balance.
- Lbs/acre receiving manure per year: divides the total pounds of nutrient imported or exported by the number of acres listed as receiving manure.
- Lbs/total tillable acres per year: divides the total pounds of nutrient imported or exported by the number of acres listed as tillable.

Diagnostics

The top rows summarize some of the information given on the first few pages of the spreadsheet. Some numbers, such as milk production and animal density, are displayed in terms of per acre receiving manure and per tillable acre. This allows some comparison of different farms of different sizes and intensities; similarly, it allows the farm to track changes if land and/or herd size change.

Animal feeds are broken down by source – imported/purchased or farm-produced. The nutrients remaining (imports – exports) are displayed in a variety of ways. Again, this puts the raw numbers (those on the top left of the report – the tons per year of imports and exports) into perspective. The % row expresses the difference between nutrients imported and exported (i.e. remaining nutrients) as a percent of imported nutrients.

Feed use efficiency shows how much (in %) of a nutrient was sold in the milk versus how much was "put in" through feed (both imported and farm-grown) (figure 5). Other numbers show the pounds of nutrients imported and remaining per hundredweight of milk. Efficiencies can thus be evaluated and compared from year-to-year, even if parameters like animal numbers change.

Question (8):

- What % of nutrients fed to Joe's animals are purchased?

Answer (8):

- Joe's Jerseys are eating mostly feed from the farm – only 7% of the feed (some grains) are bought onto the farm in the form of purchased feed.

Other Nitrogen Contributions

This section shows N balances in further detail, accounting for things like legume N fixation and atmospheric N deposition. Added to the Import – Export difference from the top segment of the report, this yields the Total N Remaining. This is then broken down by pounds per animal unit or mature cow, and then as a percent of nutrients imported.

MASS NUTRIENT BALANCE v. 4.3 OUTPUT: Joe's Jerseys 2008

Category	N	P	K	N	P	K	N	P	K
Imports	tons per year			lbs per acre receiving manure per year			lbs per total tillable acres per year		
Feed	0.71	0.07	0.18	28	3	7	19	2	5
Fertilizer	1.50	1.29	2.49	60	52	100	40	34	66
Animals	0.04	0.01	0.00	1	0	0	1	0	0
Miscellaneous	0.11	0.01	0.22	4	1	9	3	0	6
Total Imports	2.35	1.39	2.89	94	55	115	63	37	77
Exports	tons per year			lbs per acre receiving manure per year			lbs per total tillable acres per year		
Milk	2.09	0.34	0.60	83	14	24	56	9	16
Animals	0.14	0.03	0.01	6	1	0	4	1	0
Crops	0.02	0.00	0.01	1	0	1	0	0	0
Miscellaneous	-	-	-	-	-	-	-	-	-
Total Exports	2.24	0.37	0.62	90	15	25	60	10	17
Difference (Import-Export)	0.11	1.01	2.26	5	41	91	3	27	60

DIAGNOSTICS

Mature Cows	50	Acres receiving manure (% tillable)	67%	per manure acre	per tillable acre
Animal Units	76	Ratio of Cows to Heifers	1 to 0.50		
Milk production/cow/year (lbs)	15,000	Animal Density(animal units/acre)		1.52	1.02
Total legume acres	20	Milk Production (lbs/acre)		15,000	10,000
Proportion of Purchased and Farm Produced Feed					
Purchased Feed (% total feed dry matter)	7%	Farm Produced Feed (% total feed dry matter)			93%
Purchased Forage (% total feed dry matter)	-	Farm Produced Forage (% total feed dry matter)			93%
Purchased Grain (% total feed dry matter)	7%	Farm Produced Grain (% total feed dry matter)			-

Nutrients Remaining	N	P	K	Production Efficiency	N	P	K
Per animal unit (lbs)	3	27	59	Feed Use Efficiency (Milk/Feed) %	67	84	30
Per mature cow (lbs)	5	41	91	Nutrients imported per cwt milk sold	0.63	0.37	0.77
% [(Imports-Exports)/Imports]	5	73	78	Nutrients remaining per cwt milk sold	0.03	0.27	0.60

OTHER NITROGEN CONTRIBUTIONS

Source	tons/year	lbs/tillable acres
Legume N Fixation	0.41	11
Atmospheric N Deposition	0.40	11
Total other N imports	0.81	21
Total N Remaining	0.92	25
Total N Remaining/au (lbs)	24	
Total N Remaining/cow (lbs)	37	
% Total N Remaining	29%	

Legume fixation is an important source of N on many farms, but there are many uncertainties associated with this estimate. The N fixation estimate is based on the farm total legume production. If the crop is >90% legume, the estimated N fixation is 60% of the crop N content. For crops with 90% or less legume, the estimated N fixation is 36% of the crop N content.

Atmospheric nitrogen deposition is estimated at 8 lbs per total farm acre.

Figure 5. Annual Mass Nutrient Balance report. Some of the parameters mentioned in the text are highlighted; particularly difference between nutrient imports and exports (blue), % remaining imports (green), and feed use efficiency (red).

Distribution of Nutrient Imports and Exports

This report details the proportion of imports and exports due to the different enterprises on the farm – feed, fertilizer, animals, and bedding/manure/miscellaneous. This report summarizes the information that you put in, allowing a quick and easy way to double-check your numbers, or to print out and have on-hand.

Question (9):

- What import category contributes the most to Joe's nutrient imports and exports?

Answer (9):

- Joe gets most of his N, P, and K from fertilizer he uses, and ships most of it out through milk.

Itemized Nutrient Imports and Exports (%)

This report more specifically breaks down the sources of nutrients brought in or shipped out. The total values are the same as those on the Distribution of Nutrient Imports and Exports report.

Itemized Nutrient Imports and Exports (lbs per tillable acre)

This report presents the same information as the Itemized Nutrient Imports and Exports (%) report, but expresses the values as pounds per tillable acre. We can see, for instance, that Joe imports 5.7 lbs K per tillable acre due to the purchase of wheat straw, or that he brings in 66.4 lbs K per tillable acre as fertilizer.

Data Entry Report

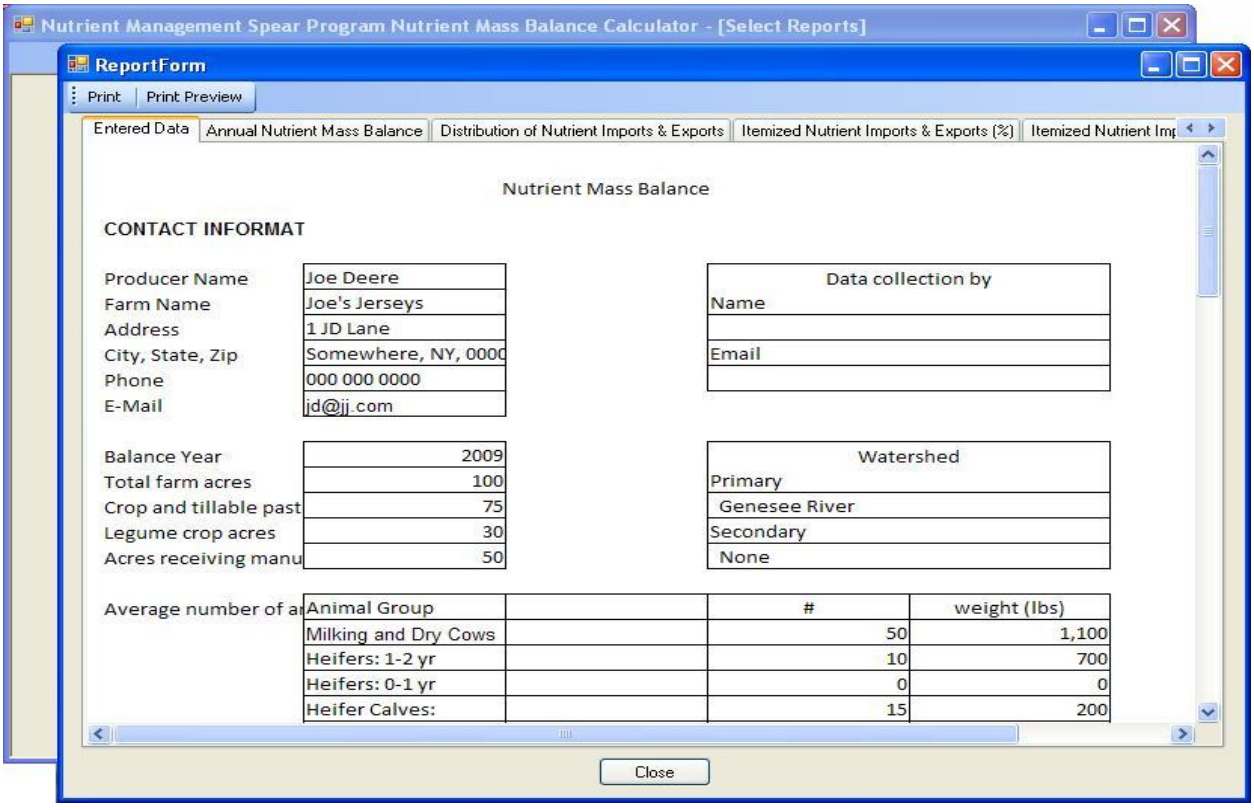


Figure 6. Data Entry report.

Some Further Analysis

Teaching Guide: *Use the program to consider management alternatives.*

After looking at Joe's data, we see that he has a near even balance of N (0.11 tons/year difference), but that P and K are less balanced (1.01 and 2.26 tons/year, respectively). What can he do to have his farm become more balanced for P and K?

To achieve a reduced Mass Nutrient Balance, Joe either needs to reduce his imports of P and K, or increase his outputs. Increasing outputs may be hard – it may not be economically viable for Joe to export manure (i.e. if he then has to buy more fertilizer instead), and he cannot easily increase the amount of P or K in milk (without increasing herd size, thus increasing nutrient demands and manure output, etc.).

Looking at the Itemized (lbs per tillable acre) report, we saw that Joe imports a lot of K through fertilizer (66.4 lbs). Often dairy farms do not need a lot of imported fertilizer K; let's assume soil test illustrate that Joe's fields are optimum or high in K. By switching to a different fertilizer blend, he may be able to reduce his K imports. Let's try this for the following year (2009).

Action 15: Return to the Home page, and "File > Transfer Current Data to New Year."

This will update the file to the next year, particularly in terms of the balances of feed and other nutrient sources. Note that it will not update animal numbers based on the animals bought and sold – this must be done manually.

Action 16: Go through the pages again, making the following adjustments:

- Remember that Joe brought in 3 replacement heifers, and sold 4 cull cows. Assume those heifers are still in the herd but have calved, so decrease the number of Milking and Dry Cows by 1 (3 bought – 4 sold = -1). Similarly, the ten 1-2 year heifers from last year calved as well – change the heifer column to 0 and add 10 to the mature cowherd (total of 59 milking cows). While 15 calves were sold last year, assume Joe kept the same amount of this year's crop – don't change that number. Joe did not buy or sell any bulls or steers, but during the past year they all gained weight. Increase the pound per head to 1500 for that row. Recall that Joe sold two does and bought one buck; decrease the "other livestock" from 10 to 9. The total AU should be 84.0.
- Note on the crop production page that the ending balances from 2008 (0 tons dry hay and 20 tons corn silage) are now the beginning balances. Keep the ending balance of hay at 0 tons, and make the ending balance for corn silage 10 tons.
- Feed purchases stay the same.
- Fertilizer purchase will change, since Joe decided to try and reduce his P and K balances. Change the 10-20-20 to 10 tons of 20-10-10.
- Joe purchased no animals. Delete the two rows.
- Miscellaneous purchases (bedding) stays the same.
- Milk sold rose to 880,000 (taking into account the new animals in the herd).
- Joe sold 2 Cull Bulls (1800 lb each).
- Crops Sold and Other Exports stay the same.

Action 17: Return to the Home page, and click the "Balance Reports" button.

Look at the different reports. A quick look at the Annual Mass Nutrient Summary shows that Joe's nutrient balances have changed. The increased N from fertilizer has driven his N difference up to 0.64 tons/year, but his P and K balances decreased. This can be seen throughout the report.

Action 18: Let's say Joe wants to compare some of the values from 2008 and 2009– specifically the Feed Use Efficiency % and Import from Purchased Fertilizer values. To access an old report, return to the home page. Click "File > Load Existing Balance." You will see a list of saved files, at this point containing only "Joe'sJerseys_2008.mnbx" and "Joe'sJerseys_2009.mnbx." Select the 2008 file, and then pull up the appropriate reports. Without closing the report page, switch back to the program screen and return to the Home page. Load the 2009 balance, and open the reports from that file. You can now compare the two (figure 7).

Itemized N, P and K imports and exports (pounds per tillable acre): Joe's Jerseys 2008

Itemized N, P, K imports			
	----------lbs per tillable acre----------		
Import from purchased feed	N	P	K
Soybean Meal 44	15.3	1.4	4.3
Brewers Grains-Wet	3.6	0.6	0.5
Import from purchased fertilizer	N	P	K
10-20-20	40.0	34.4	66.4
Import from purchased animals	N	P	K
Buck	0.0	0.0	0.0
Replacement Heifers	0.9	0.2	0.1
Import from miscellaneous imports	N	P	K
Wheat Straw	2.9	0.4	5.7
Total Imports (lbs/tillable acre)	62.8	37.0	77.0

Itemized N, P and K imports and exports (pounds per tillable acre): Joe's Jerseys 2009

Itemized N, P, K imports			
	----------lbs per tillable acre----------		
Import from purchased feed	N	P	K
Soybean Meal 44	24.0	2.1	6.7
Brewers Grains-Wet	5.0	0.8	0.7
Import from purchased fertilizer	N	P	K
20-10-10	53.3	11.5	22.1
Import from purchased animals	N	P	K
	-	-	-
Import from miscellaneous imports	N	P	K
Wheat Straw	2.9	0.4	5.7
Total Imports (lbs/tillable acre)	85.1	14.8	35.2

Figure 7. Comparison of 2008 and 2009 Itemized N, P, and K imports and exports reports.

Question (10):

- What has changed and why?

Answer (10):

- Annual Nutrient Mass Balance: we can see that Joe's N imports from fertilizer increased (1.50 to 2.00 tons), but the P and K imports decreased (1.29 to 0.43 for P, and 2.49 to 0.83 for K). In terms of Production Efficiency, the Feed Use Efficiency increased for all three nutrients, while the Nutrients remaining decreased for P and K, as would be expected.
- Distribution of Nutrient Imports and Exports: as anticipated, the % of imports from fertilizer for P and K decreased. Accordingly, the proportion from other imports (bedding and feed) increased. Again, this is not because more nutrients were necessarily imported through those routes – a larger portion of total imported nutrients came through them.
- Itemized Nutrient Imports and Exports (lbs/acre): this also shows an appreciable drop in overall P and K imports.
- The absolute tons of imported P and K decreased in 2009 due to a change in fertilizer type; there was a smaller change in the % P and K imports from that source.

Exporting Data to Cornell Nutrient Management Spear Program

Teaching Guide: *To save the data in a format that will allow inclusion in and comparison to a multiple year, state-wide dataset.*

Now that the information has been entered, and you have looked at the mass nutrient balance summaries, you can send the data to Cornell University's Nutrient Management Spear Program to be added to the database of participating farms.

Action 20: On the home screen, select File > Export Data for Cornell. This will convert the data into a .zip file, which is what the database will need. A small pop-up box will appear (figure 8), indicating that the export (file conversion) has taken place, and giving the location that the file was saved. The title of the file will be C:\MNB\farmname_year.zip.

Figure 8. Pop-up screen indicating the successful conversion of the data file. Note the location and filename of the data, which will be used to send the data to Cornell via email.

At this point, the data have not been sent to Cornell! Note the location given in the pop-up, and select "Okay". To send the converted file, attach the file to an email sent to Caroline Rasmussen (cnr2@cornell.edu). Be sure to attach the .zip file – when you search for the file on an email program, there will be other files with similar names (figure 9).

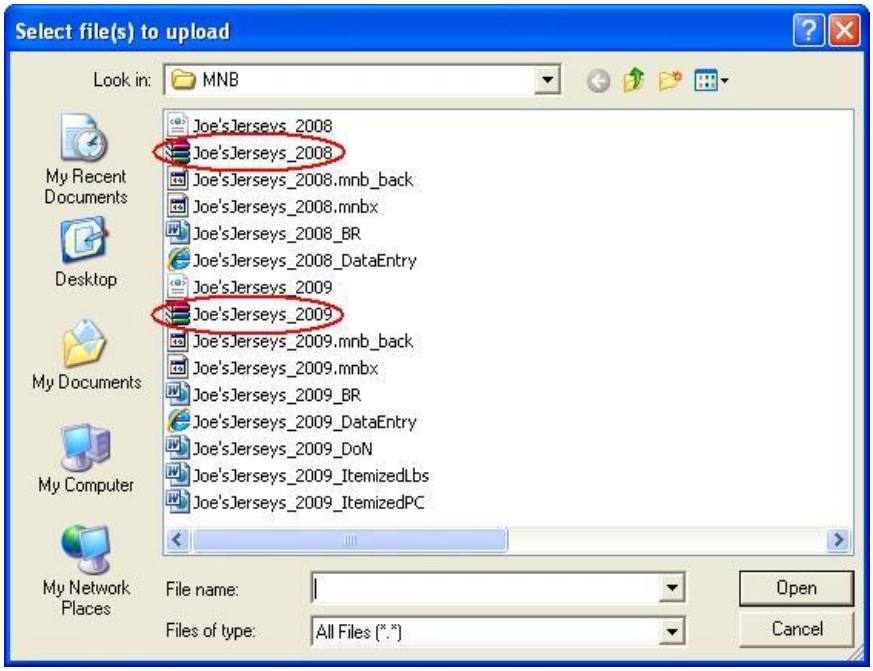


Figure 9. Identifying the correct file to email. You may find multiple files with similar names when attaching a file for email, but the ones you want are .zip files (circled in red). Note the multicolored icon to the left of the filename, indicating a .zip file. Moving the mouse over the filename will cause pop-up text to appear, indicating the file type.

Farm Analysis with the Nutrient Mass Balance

Question (11):

- Enter data from entry sheets found on the next four pages into the NMB program.
- Print the Annual Mass Nutrient Summary Report.
- Mark an "x" on each of the graphs shown on pages 26-27 to indicate where the Homework farm would appear.
- Enter the Homework Farm values in the column "Homework farm" for the quartile phosphorus balance report (page 28).

Cornell Nutrient Management Spear Program
Mass Nutrient Balance Calculator Input Sheet

N, P and K imports and exports, 1/1/2010 to 12/31/2010

Producer Contact Information		Data Collection	
Producer name	Homework Farm	**By**	
Farm name		**Email**	
Address			
City, state, zip		**Balance year**	2010
Phone			
E-mail			

Farm Information		Watershed	
Total farm acres	300	**Primary**	Susquehanna
All tillable owned and rented crop and pasture acres	190	**Secondary**	
Legume acres (perennial and annual) >10% legume	25		
Acres receiving manure (crop and pasture)	165		

Have you completed a Cornell Dairy Farm Business Summary (DFBS) for the balance year?	y / n
Have you completed a Farm Credit Business Summary for the balance year?	y / n
Are you a Certified Organic producer?	y / n
Intensive Grazing (grazed at least 3 months/yr, moved to new pen every 3 days or more)?	y / n
Do you have a Comprehensive Nutrient Management Plan (CNMP) for the balance year?	y / n
Do you have a Cornell Cropware plan for the balance year?	y / n

Average number and weight of farm livestock	Animal Group	Number	Weight (lbs/head)
	Milking and Dry Cows	135	1400
	Heifers > 1 year	60	700
	Heifers 6 mon-1 year	60	300
	Calves < 6 mon	10	150
	Bulls & Steers		
	Other Livestock		

FARM CROP PRODUCTION:

Crop Name	% Legume	Acres	Manure Applied	CP (%DM)	P (%DM)	K (%DM)	Crop Type*	%DM	Yield (t/a)	Inventory (tons) Beginning year	Inventory (tons) Ending year
grass	0	165	y/n	22.2	.42	3.25	F	40	13	562	462
mml	60	25	y/n	28	.3	2.7	F	42	14	-	20
			y/n								
			y/n								
			y/n								
			y/n								
			y/n								
			y/n								
			y/n								
			y/n								
			y/n								
			y/n								

* Crop type = "forage", "grain" or "bedding"

Feeds (purchased)	Tons /year	% DM	CP (%DM)	P (%DM)	K (%DM)	Feed Type*	% forage (if TMR)	Inventory Beg. year (as fed tons)	Inventory Ending year (as fed tons)
Corn Silage	1200	32	7.5	.21	.84	F		900	300
HAY Heifer	80	90	10	.32	2.3	F		30	50
Calf grain	2	90	22	.69	1.14	G		-	-
Cow grain	520	90	18	.66	1.22	G		-	-
Heifer grain	50	90	18.5	.65	1.23	G		-	-
Corn HM grain	5	look up in Feed Table							

* Feed type = "Grain", "Forage" or "TMR".

Purchased fertilizers	Tons/year	% N	% P_2O_5	% K_2O	Comment
Urea	10	32			
Potash	2.5			60	

Purchased animals	Type*	Description	Number	Weight/hd (lbs)
Heifer Dairy	Dairy	Heifer	1	1000

* Type = "Dairy", "Beef", "Swine", "Poultry", "Goats", "Sheep", "Horses"

Bedding and miscellaneous imports	Tons/year	% DM	N (%DM)	P (%DM)	K (%DM)
Sawdust	21	94.3	.11	.01	.05

EXPORTS	
Milk sold (lbs/year)	Milk Protein (%)
2,430,100	3.1

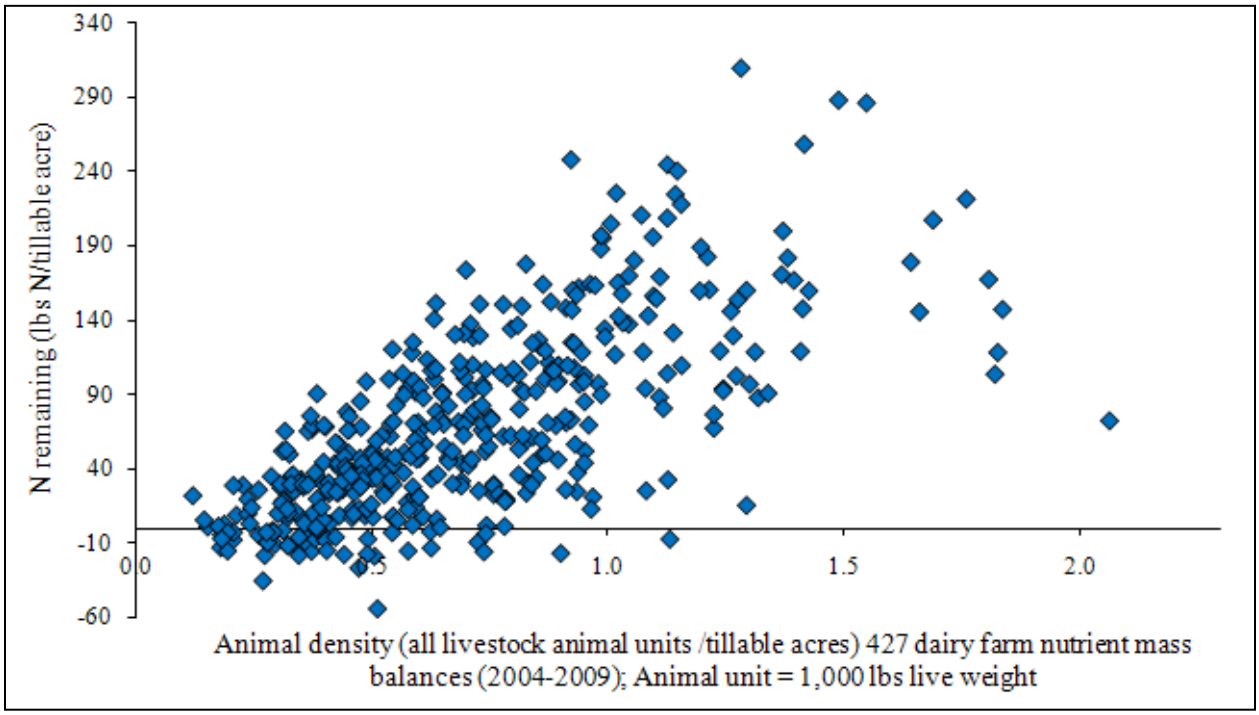
Animals Sold	Type*	Description	Number	Weight/hd (lbs)
Cull Cows	Dairy	cull	24	1400
bull calves	Dairy	bulls	50	90

* Type = "Dairy", "Beef", "Swine", "Poultry", "Goats", "Sheep", "Horses"

Crops Sold	Tons/year	%DM	CP (%DM)	P (%DM)	K (%DM)	Feed Type*	
MmL	10	42	28	.3	3.7	F	
							% forage
TMR							

* Feed type = "Grain", "Forage" or "TMR".

Manure, compost and other exports	Tons/year	% solids	N (% wet)	P (% wet)	K (% wet)


340
290
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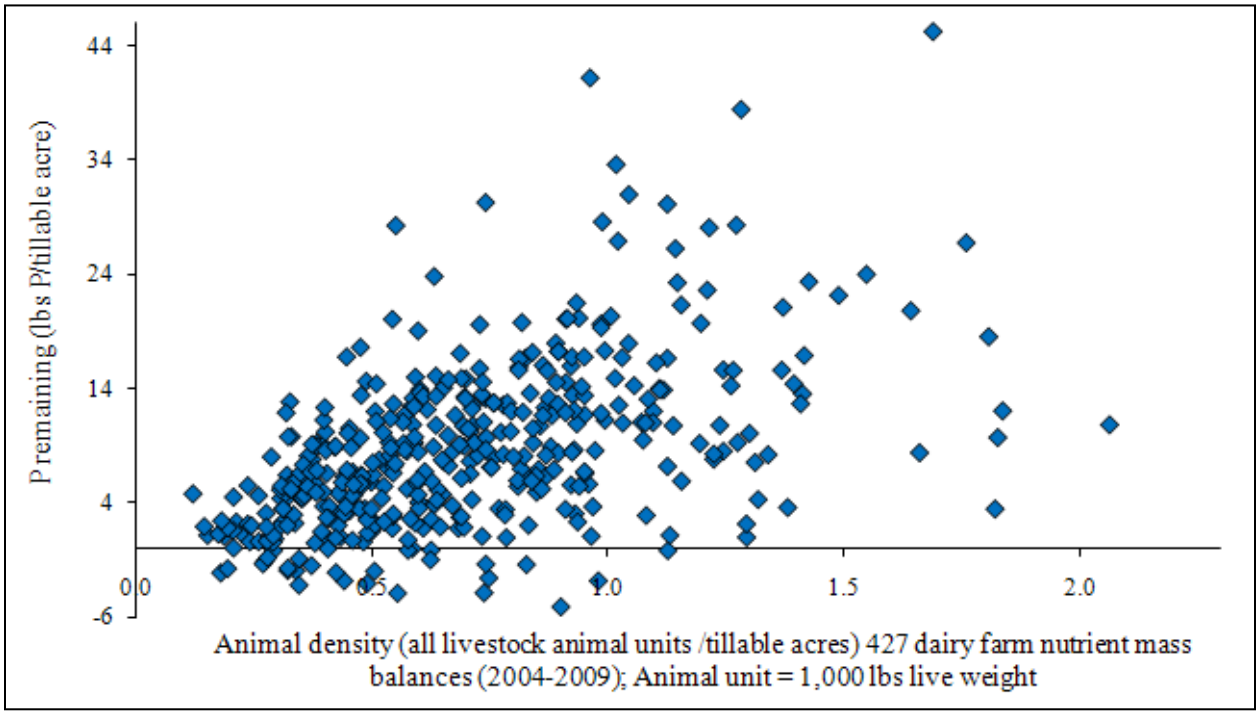
-10
-60
N remaining (lbs N/tillable acre)
0
0
1.0
1.5
2.0
Animal density (all livestock animal units /tillable acres) 427 dairy farm nutrient mass balances (2004-2009); Animal unit = 1,000 lbs live weight


44
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P remaining (lbs P/tillable acre)
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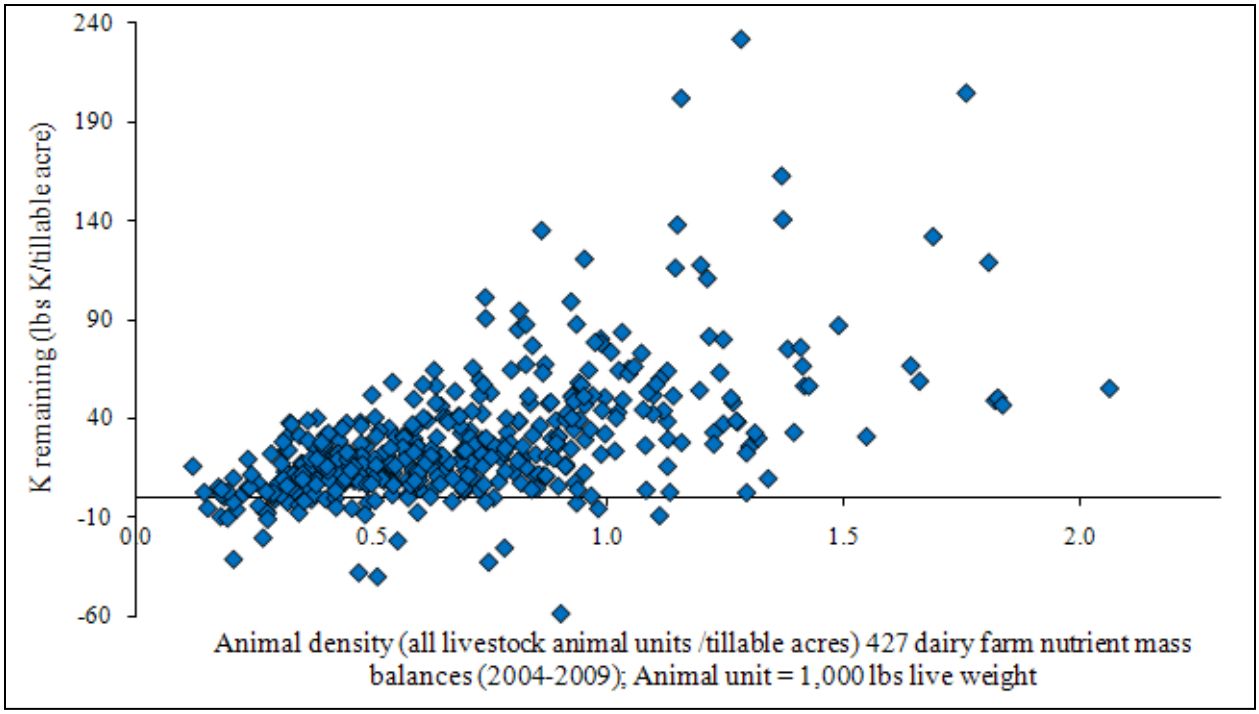
Animal density (all livestock animal units /tillable acres) 427 dairy farm nutrient mass balances (2004-2009); Animal unit = 1,000 lbs live weight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2.0
K remaining (lbs K/tillable acre)
Animal density (all livestock animal units /tillable acres) 427 dairy farm nutrient mass balances (2004-2009); Animal unit = 1,000 lbs live weight

	Phosphorus balance (lbs/tillable acre)				
Item	my farm	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Phosphorus remaining (lbs/acre)		less than 2.5	2.5 to 6.9	6.9 to 11.5	more than 11.5
Number of farms		17	16	16	16
Business Size & Production					
Mature cows		157	357	820	329
Animal units		305	835	1,516	693
Animal density		0.44	0.60	0.95	0.99
Milk sold (lbs/cow)		16,826	19,814	22,933	20,335
Milk sold (lbs/acre)		4,172	6,303	12,759	10,620
Tillable acres		611	670	1,436	621
% purchased feed (% of total feed)		13%	21%	28%	38%
% farm produced forage (% of total feed)		77%	71%	71%	60%
Ratio cows to heifers (1:)		0.88	0.82	0.59	0.76
% tillable acres receiving manure		52%	60%	74%	77%
Phosphorus Mass Balance					
Tons P remaining		(0.18)	1.38	6.41	4.32
Lbs P remaining/acre receiving manure		(2)	10	13	22
Lbs P remaining/acre		(1)	5	9	16
Lbs P remaining/au		(2)	10	11	17
% P remaining (import-export/import)		-86%	42%	41%	56%
Efficiency Measures					
P imports/cwt milk sold		0.17	0.22	0.21	0.28
P exports/cwt milk sold		0.18	0.12	0.12	0.12
P remaining/cwt milk sold		(0.01)	0.10	0.09	0.16
P feed use efficiency [milk P/total feed P]		17%	20%	25%	22%
Distribution of imported P					
P from purchased feed (lbs P/tillable acre)		4	9	20	22
P from purchased fertilizer (lbs P/tillable acre)		2	3	4	6
P from purchased animals (lbs P/tillable acre)		0	0	0	0
P from bedding (lbs P/tillable acre)		0	0	0	0
Distribution of exported P					
P from milk sales (lbs P/tillable acre)		4	6	11	10
P from animal sales (lbs P/tillable acre)		1	1	2	2
P from crop sales (lbs P/tillable acre)		2	1	0	1
P from manure / compost (lbs P/tillable acre)		1	0	2	1

Answer (11):

MASS NUTRIENT BALANCE v. 4.3 OUTPUT: Homework Farm 2010

Category	N	P	K	N	P	K	N	P	K
Imports	tons per year			lbs per acre receiving manure per year			lbs per total tillable acres per year		
Feed	22.71	4.79	12.38	277	58	151	239	50	130
Fertilizer	3.20	0.00	1.25	39	0	15	34	0	13
Animals	0.01	0.00	0.00	0	0	0	0	0	0
Miscellaneous	0.02	0.00	0.01	0	0	0	0	0	0
Total Imports	25.94	4.79	13.63	316	58	166	273	50	143
Exports	tons per year			lbs per acre receiving manure per year			lbs per total tillable acres per year		
Milk	6.35	1.09	1.94	77	13	24	67	12	20
Animals	0.55	0.13	0.04	7	2	0	6	1	0
Crops	0.19	0.01	0.11	2	0	1	2	0	1
Miscellaneous	-	-	-	-	-	-	-	-	-
Total Exports	7.09	1.24	2.10	86	15	26	75	13	22
Difference (Import-Export)	18.86	3.55	11.54	230	43	141	198	37	121

DIAGNOSTICS

Mature Cows	135	Acres receiving manure (% tillable)	86%	per manure acre	per tillable acre
Animal Units	251	Ratio of Cows to Heifers	1 to 0.96		
Milk production/cow/year (lbs)	18,001	Animal Density(animal units/acre)		1.53	1.32
Total legume acres	25	Milk Production (lbs/acre)		14,818	12,790

Proportion of Purchased and Farm Produced Feed			
Purchased Feed (% total feed dry matter)	53%	Farm Produced Feed (% total feed dry matter)	47%
Purchased Forage (% total feed dry matter)	29%	Farm Produced Forage (% total feed dry matter)	47%
Purchased Grain (% total feed dry matter)	24%	Farm Produced Grain (% total feed dry matter)	-

Nutrients Remaining	N	P	K	Production Efficiency	N	P	K
Per animal unit (lbs)	151	28	92	Feed Use Efficiency (Milk/Feed) %	10	12	4
Per mature cow (lbs)	279	53	171	Nutrients imported per cwt milk sold	2.14	0.39	1.12
% [(Imports-Exports)/Imports]	73	74	85	Nutrients remaining per cwt milk sold	1.55	0.29	0.95

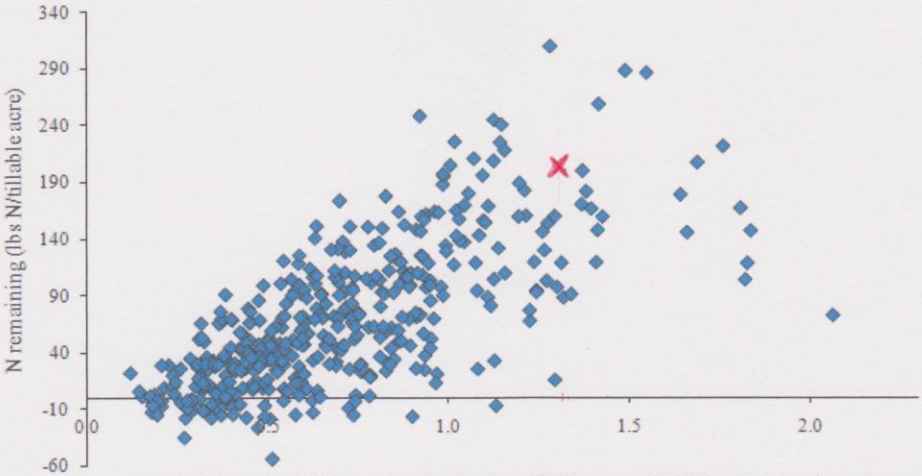
OTHER NITROGEN CONTRIBUTIONS

Source	tons/year	lbs/tillable acres
Legume N Fixation	2.37	25
Atmospheric N Deposition	1.20	13
Total other N imports	3.57	38
Total N Remaining	22.43	236
Total N Remaining/au (lbs)	179	
Total N Remaining/cow (lbs)	332	
% Total N Remaining	76%	

Legume fixation is an important source of N on many farms, but there are many uncertainties associated with this estimate. The N fixation estimate is based on the farm total legume production. If the crop is >90% legume, the estimated N fixation is 60% of the crop N content. For crops with 90% or less legume, the estimated N fixation is 36% of the crop N content.

Atmospheric nitrogen deposition is estimated at 8 lbs per total farm acre.

3/7/2011


N remaining (lbs N/tillable acre)
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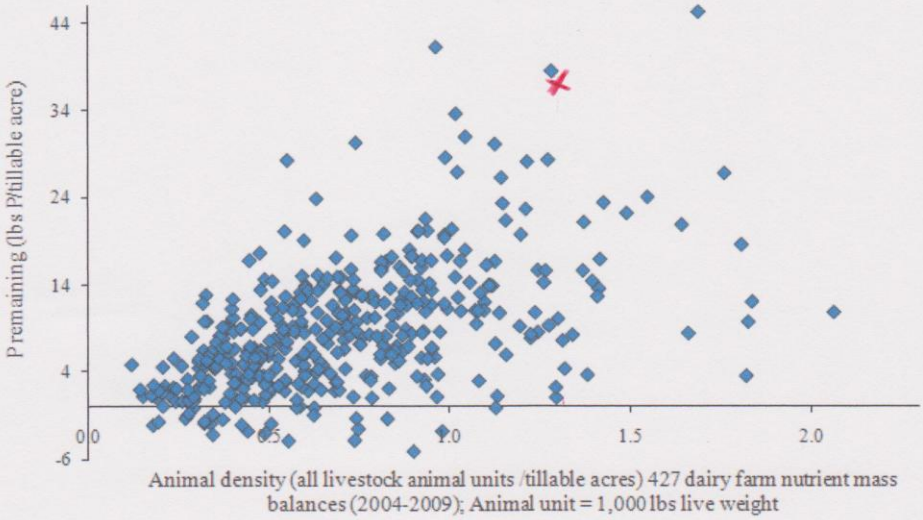
Animal density (all livestock animal units /tillable acres) 427 dairy farm nutrient mass balances (2004-2009); Animal unit = 1,000 lbs live weight


P remaining (lbs P/tillable acre)
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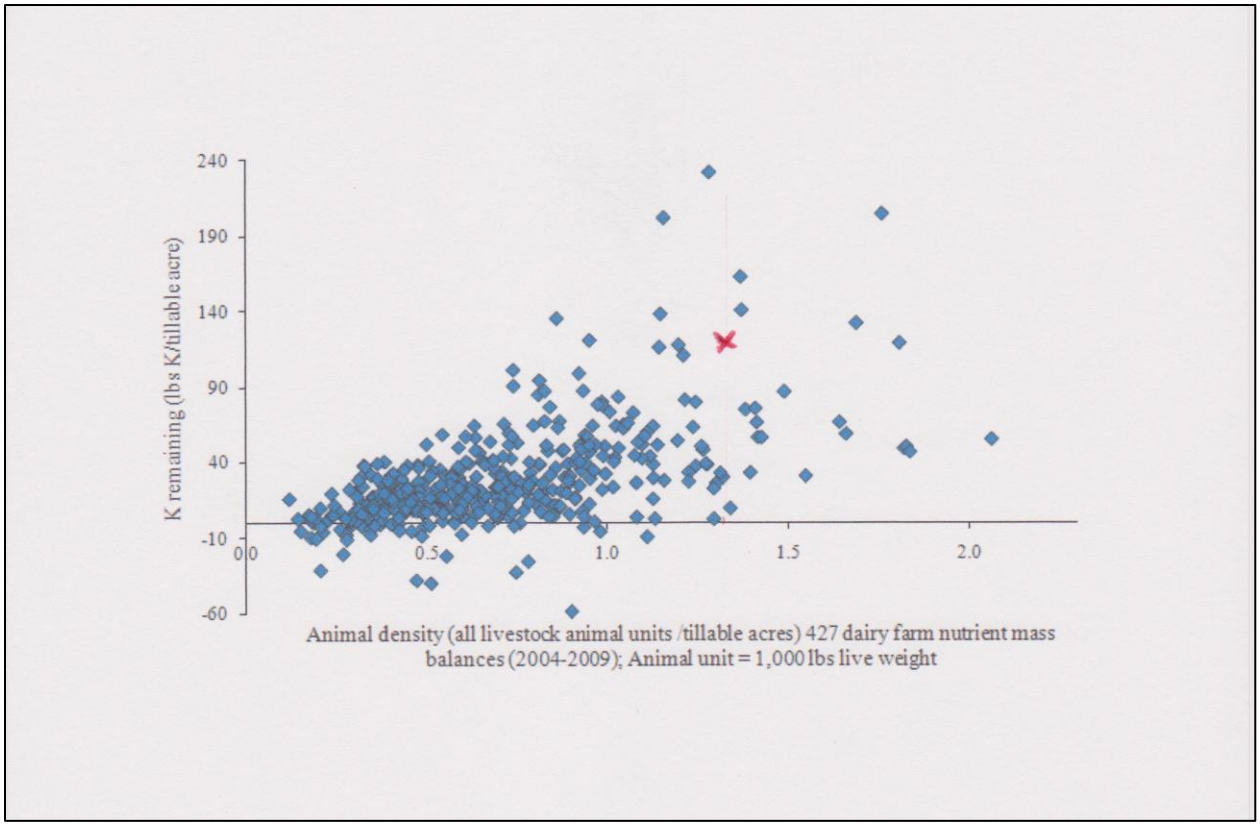
Animal density (all livestock animal units /tillable acres) 427 dairy farm nutrient mass balances (2004-2009); Animal unit = 1,000 lbs live weight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K remaining (lbs K/tillable acre)
Animal density (all livestock animal units /tillable acres) 427 dairy farm nutrient mass balances (2004-2009); Animal unit = 1,000 lbs live weight

	Phosphorus balance (lbs/tillable acre)				
Item	my farm	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Phosphorus remaining (lbs/acre)	37	less than 2.5	2.5 to 6.9	6.9 to 11.5	more than 11.5
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Business Size & Production					
Mature cows	135	157	357	820	329
Animal units	251	305	835	1,516	693
Animal density	1.32	0.44	0.60	0.95	0.99
Milk sold (lbs/cow)	18,001	16,826	19,814	22,933	20,335
Milk sold (lbs/acre)	12,770	4,172	6,303	12,759	10,620
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% farm produced forage (% of total feed)	47%	77%	71%	71%	60%
Ratio cows to heifers (1:)	0.96	0.88	0.82	0.59	0.76
% tillable acres receiving manure	86%	52%	60%	74%	77%
Phosphorus Mass Balance					
Tons P remaining	3.55	(0.18)	1.38	6.41	4.32
Lbs P remaining/acre receiving manure	43	(2)	10	13	22
Lbs P remaining/acre	37	(1)	5	9	16
Lbs P remaining/au	28	(2)	10	11	17
% P remaining (import-export/import)	74%	-86%	42%	41%	56%
Efficiency Measures					
P imports/cwt milk sold	0.39	0.17	0.22	0.21	0.28
P exports/cwt milk sold	0.10	0.18	0.12	0.12	0.12
P remaining/cwt milk sold	0.29	(0.01)	0.10	0.09	0.16
P feed use efficiency [milk P/total feed P]	12%	17%	20%	25%	22%
Distribution of imported P					
P from purchased feed (lbs P/tillable acre)	50	4	9	20	22
P from purchased fertilizer (lbs P/tillable acre)	-	2	3	4	6
P from purchased animals (lbs P/tillable acre)	-	0	0	0	0
P from bedding (lbs P/tillable acre)	-	0	0	0	0
Distribution of exported P					
P from milk sales (lbs P/tillable acre)	12	4	6	11	10
P from animal sales (lbs P/tillable acre)	1	1	1	2	2
P from crop sales (lbs P/tillable acre)	0	2	1	0	1
P from manure / compost (lbs P/tillable acre)	-	1	0	2	1

Appendix:

- Agronomy Fact Sheet # 25: Mass Nutrient Balance Software
- Mass Nutrient Balance Input Form
- Mass Nutrient Balance Input Form Instructions

Mass Nutrient Balance Software

Introduction

For the sustainability of the dairy sector in New York State, it is important to find ways to enhance profitability while minimizing environmental loss of nitrogen (N) and phosphorus (P). This requires farms to maintain sustainable farm-gate nutrient balances. A nutrient balance is defined as the difference between the amount of N, P, and potassium (K) imported through purchased products and the amounts exported off the farm via milk, meat, crops, manure and/or compost (Figure 1). Such assessments can help identify management alternatives that can enhance whole farm nutrient use efficiency (and hence reduce nutrient losses) and increase farm profitability.

In this agronomy fact sheet we describe how to use the Mass Nutrient Balance software to derive a farm's N, P and K balance.

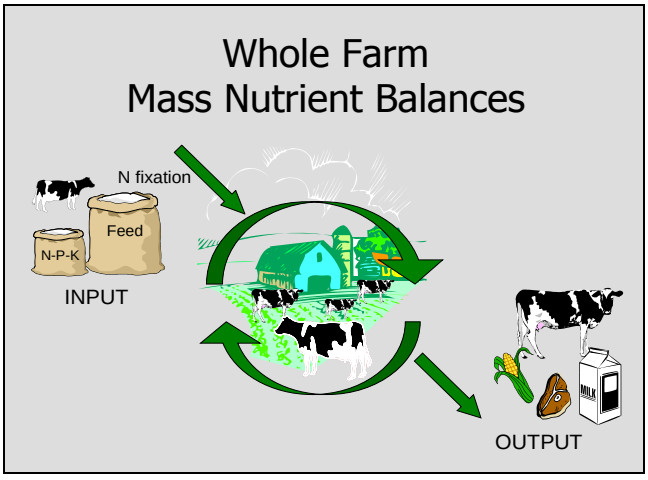

Figure 1: A farm mass nutrient balance is the difference between nutrient (N, P, and K) imports and exports.

What Can Mass Nutrient Balance Do?

A Mass Nutrient Balance analysis helps farm managers determine where the greatest nutrient use inefficiencies occur. A software program ("Mass Nutrient Balance") was developed to allow users to:

- Calculate the amount of nutrients being imported, exported, and recycled through the production of pasture and crops.
- Calculate the amount of nutrients being imported to the farm in the form of purchased feeds (i.e. not homegrown), fertilizers, animals, and bedding material.
- Calculate the amount of nutrients being exported from the farm in the form of products sold including, feed, milk, animals, crops, and manure/compost.
- Generate reports that show farm N, P and K imports and exports in tons for the whole farm and in pounds per acre cropland, per pound of product sold, or per animal unit.
- Identify areas of concern and opportunities for more efficient nutrient use that, if addressed, could increase profitability and reduce environmental impact.

Where Do I Start?

Step 1: Obtain the Mass Nutrient Balance Input Data Form.

- This form (three pages) can be downloaded from the Mass Nutrient Balance webpage of the Nutrient Management Spear Program: http://nmsp.cals.cornell.edu/projects/massbalance.html.

Step 2: Record Keeping.

- Throughout the year, keep records of the quantities of feed, fertilizer and other materials purchased as identified in the Input Data Form. The record keeping booklet is designed to help with this too.

Step 3: Fill out the Input Data Form.

- Print the Input Data Form from the Nutrient Management Spear Program website.
- At the top of the sheet, write down the producer and farm information including the number of farm acres and animals.
- Fill out the Crop production section including farm-produced legumes, non-legumes and pasture. Forage analyses are helpful to obtain accurate values for crude protein, P and K.
- Fill out the Imports section which includes all feeds, fertilizers, animals, and bedding purchased or brought onto the farm. Forage

analyses are also helpful for this section. If feed composition values are not available from farm analysis or from feed companies and nutritionists, the software provides standard, "book values" for common feeds.
- Fill out the Exports section which includes any crops, milk, animals, and manure or compost that is sold or moved off the farm.

Step 4: Download the Nutrient Mass Balance Calculator and Install
- This software requires Windows XP or later and at least 5 Mb of storage.
- Download free of charge from: http://nmsp.cals.cornell.edu/projects/massbalance.html. After clicking on "Download the Nutrient Mass Balance Calculator**",** click "run" and follow the on-screen instructions. The program installation will place the program name in your Start menu.

Step 5: Fill out the Whole Farm Nutrient Balance Spreadsheet.
- Click on "Start Program" to see the screen below (Figure 2).
- For additional help, download the Help file, accessible at the same project website**.**

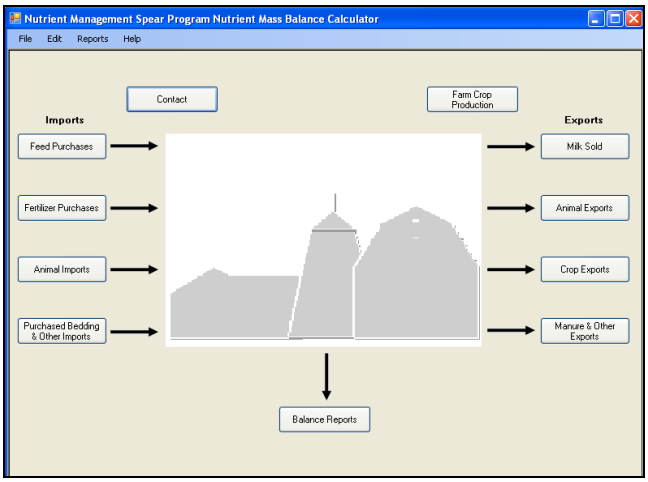

Figure 2: Nutrient Balance Mass program Menu". Input buttons are on the left, export buttons on the right.

- Click on the Contact button and enter the contact information from the completed Data Input Form into the appropriate fields.
- Click Next to go to the next input screen, Farm Crop Production.
- In the Farm Crop Production Screen enter the appropriate crop production information from the Data Input Form. Remember to enter crop and pasture production on rented as well as owned land.
- Continue to transfer the information from the Input Form to the import and export sites of the software.
- When you are finished with entering all the information from the Data Input Form, click on "Home' to return to the main menu. Click on the Balance Reports button to see the results of your mass balance assessment.
- Data are automatically saved as you move from one data entry field to the next.
- You can save put your data into a format to send to the Nutrient Management Spear Program to obtain a comparison between your farm and all farms in the database to date by choosing "Export Data for Cornell" in the File drop down menu at the top of the screen. You must then attach the resulting file ("your farm name_balance year.zip") to an email and send it to cnr2@cornell.edu. All Mass Nutrient Balance data/results are kept strictly confidential. In your farm comparison report, your farm will be one of many data points on the charts.

For Support and/or Training

If you need help transferring your information from the Data Input Form into the software, send the completed Data Input Form to Caroline Rasmussen, Nutrient Management Spear Program, 325 Morrison Hall, Cornell University 14853. For further information, contact Caroline Rasmussen (cnr2@cornell.edu or 607-255-9829) or Quirine Ketterings (qmk2@cornell.edu or 607 255-3061).

Disclaimer

This fact 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 fact 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

Nutrient Management Spear Program
http://nmsp.cals.cornell.edu

Caroline Rasmussen, Sarah Moss,
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2010

Cornell Nutrient Management Spear Program
Mass Nutrient Balance Calculator Input Sheet

N, P and K imports and exports, 1/1/2010 to 12/31/2010

Producer Contact Information		Data Collection	
Producer name		**By**	
Farm name		**Email**	
Address			
City, state, zip		**Balance year**	**2010**
Phone			
E-mail			

Farm Information		Watershed	
Total farm acres		**Primary**	
All tillable owned and rented crop and pasture acres		**Secondary**	
Legume acres (perennial and annual) >10% legume			
Acres receiving manure (crop and pasture)			

Have you completed a Cornell Dairy Farm Business Summary (DFBS) for the balance year?	**y / n**
Have you completed a Farm Credit Business Summary for the balance year?	**y / n**
Are you a Certified Organic producer?	**y / n**
Intensive Grazing (grazed at least 3 months/yr, moved to new pen every 3 days or more)?	**y / n**
Do you have a Comprehensive Nutrient Management Plan (CNMP) for the balance year?	**y / n**
Do you have a Cornell Cropware plan for the balance year?	**y / n**

Average number and weight of farm livestock

Animal Group	Number	Weight (lbs/head)
Milking and Dry Cows		
Heifers > 1 year		
Heifers 6 mon-1 year		
Calves < 6 mon		
Bulls & Steers		
Other Livestock		

FARM CROP PRODUCTION:

										Inventory (tons)	
Crop Name	% Legume	Acres	Manure Applied	CP (%DM)	P (%DM)	K (%DM)	Crop Type*	%DM	Yield (t/a)	Beginning year	Ending year
			y/n								
			y/n								
			y/n								
			y/n								
			y/n								
			y/n								
			y/n								
			y/n								
			y/n								
			y/n								
			y/n								
			y/n								

* Crop type = "forage", "grain" or "bedding"

IMPORTS								**Inventory**	
Feeds (purchased)	**Tons /year**	**% DM**	**CP (%DM)**	**P (%DM)**	**K (%DM)**	**Feed Type***	**% forage (if TMR)**	**Beg. year (as fed tons)**	**Ending year (as fed tons)**

* Feed type = "Grain", "Forage" or "TMR".

Purchased fertilizers	Tons/year	% N	% P_2O_5	% K_2O	Comment

Purchased animals	Type*	Description	Number	Weight/hd (lbs)

* Type = “Dairy”, “Beef”, “Swine”, “Poultry”, “Goats”, “Sheep”, “Horses”

Bedding and miscellaneous imports	Tons/year	% DM	N (%DM)	P (%DM)	K (%DM)

EXPORTS	
Milk sold (lbs/year)	Milk Protein (%)

Animals Sold	Type*	Description	Number	Weight/hd (lbs)

* Type = “Dairy”, “Beef”, “Swine”, “Poultry”, “Goats”, “Sheep”, “Horses”

Crops Sold	Tons/year	%DM	CP (%DM)	P (%DM)	K (%DM)	Feed Type*	
							% forage
TMR							

* Feed type = "Grain", "Forage" or "TMR".

Manure, compost and other exports	Tons/year	% solids	N (% wet)	P (% wet)	K (% wet)

Cornell Nutrient Management Spear Program
Mass Nutrient Balance Input Form Instructions
March 7, 2011

INTRODUCTION

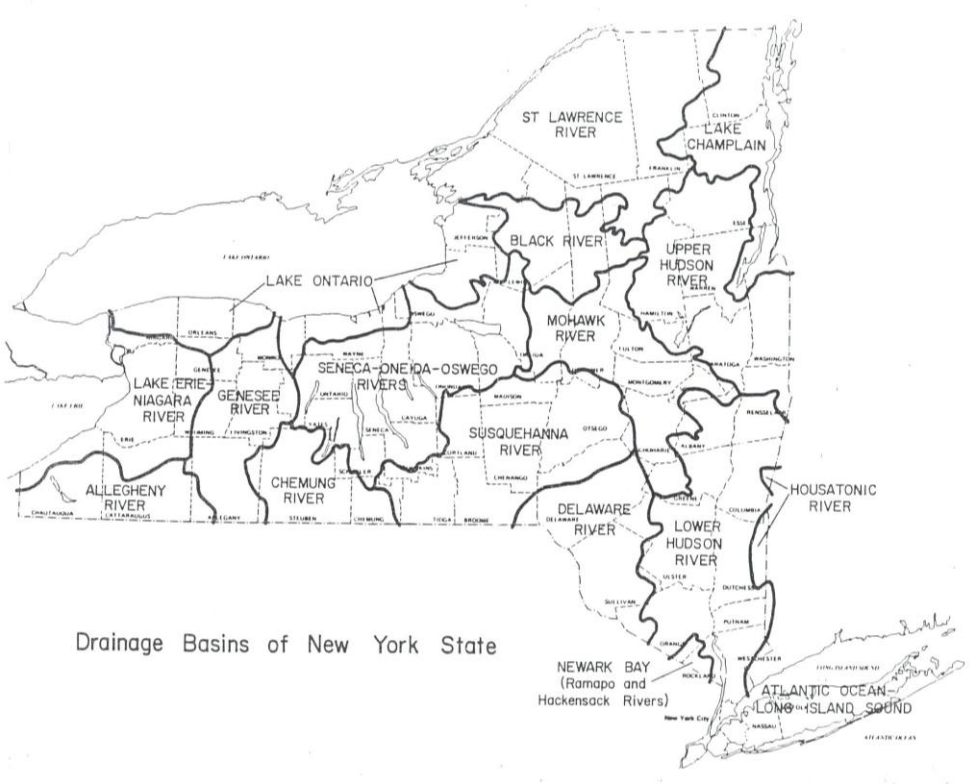
The purpose of this input form is to collect the necessary data for developing a whole farm mass nutrient balance. This form can be used to develop a mass nutrient balance for any type of livestock operation (dairy, swine, poultry, etc.), or for non-livestock farms. For non-livestock farms, ignore all questions concerning animals. Send completed from to: Caroline Rasmussen, 325 Morrison Hall, Cornell University, Ithaca NY 14853. FAX: 607 255-9829 Attn: Caroline Rasmussen. Email: cnr2@cornell.edu.

FARM CHARACTERISTICS

Producer Contact Information:
Record the producer contact information, including address, phone and email (if available).

Data Collection:
Enter the name and email address of the CCE or agency professional collecting the data (if applicable). Enter data for the calendar year January 1, 2010 to December 31, 2010.

Watershed:
Enter the watershed where most of the farm owned and rented land is located in the "Primary" box (see the map below). If the farm is in two watersheds, enter the watershed that has the smaller farm area in the "Secondary" box.



Drainage Basins of New York State

Farm Information

Total farm acres: Enter the total owned and rented farm acres (including buildings and woodlands).

All legume and non-legume tillable crop and pasture acres: Enter the total number of crop and potentially tillable pasture acres owned and rented.

Legume acres (perennial and annual) >10% legume: Enter all crop and tillable pasture acres, both annual and perennial that have more than 10% legume plant content.

Acres receiving manure (crop and pasture): Enter the total number of acres owned and rented that receive manure either by mechanical spreading and/or animal grazing.

Enter “yes” or “no” to the questions concerning the Cornell Dairy Farm Business Summary, the Farm Credit Business Summary, organic certification, intensive grazing, having a Comprehensive Nutrient Management Plan (CNMP) and having a Cornell Cropware Plan.

Animal Information

Enter the average number and weight per head of animals on the farm during the balance year. On dairy and beef farms, group all mature cows (milking and dry) on the first line. These are cows that have freshened one or more times. This information is used to calculate total animal units (AU). An animal unit is equal to 1,000 lbs live weight. The total animal units are the combined weight (lbs) of all animals divided by 1,000.

FARM CROP PRODUCTION

Record all crop and pasture production. Include crops grown for feed and for off-farm sale. Enter the percent legume in the stand. If a legume % greater than 0 is entered, check the box if manure was also spread (mechanically or by grazing livestock) on the same acreage. Enter the number of acres, the crude protein (CP), phosphorus (P) and potassium (K) content of the harvested crop (% dry matter). Select “forage”, “grain” or “Bedding” to describe the harvested crop. If you choose to enter the yield and inventory balances as dry matter, you can enter 100% in the DM% cell. If you will enter the yield per acre and inventories in as-fed tons, enter the harvested crop dry matter content as a percentage. If there is a change in the beginning and ending calendar year inventory of a crop produced for feed or sale, record the beginning and ending year inventory. Enter the average yield in tons (dry matter or as-fed, as selected in the previous column) per acre. If you enter the yield on a dry matter basis, also enter beginning and ending year inventories on a dry mater basis. If you entered the yield on an as-fed basis, enter the inventory on the same as-fed basis.

If crop production records are not available, the quantity harvested can be estimated as shown below. Keep in mind, the shrink_fraction is the percent shrink entered as a fraction. All other inputs are in tons.

Quantity harvested =

$$[\text{Beginning\_inventory} + (\text{daily\_feed\_out} * \text{days\_since\_harvest}) - \text{current\_inventory}] * [1 + \text{shrink\_fraction})$$

Harvested Yield = Quantity harvested / Acres harvested

NUTRIENT IMPORTS

Feeds Purchased:

Record the type of feed, tons purchased per year, and the percentages of dry matter, crude protein, P, and K. Select the feed type: “Grain”, “Forage” or “TMR”. The "% forage" is only entered when TMR is selected. If there is a change in the beginning and ending calendar year purchased feed inventory, record the beginning and ending year inventory in tons as-fed.

Purchased fertilizers:

Record the fertilizer type, tons purchased per year, and the percentages of N, P_2O_5, and K_2O.

Purchased animals:

Record the number of adults and young stock purchased, and the average weight per head in lbs.

Bedding and miscellaneous imports:

Record the number of tons, percent dry matter, N, P and K (% dry matter) for all bedding material purchased or other miscellaneous imports. Do not enter farm produced bedding.

NUTRIENT EXPORTS

Milk sold:

Enter the annual total amount of milk sold (in lbs) and the average percent milk protein, as reported on the milk check.

Animals exported:

Enter the number and average live weight per head of all animals sold or exported from the farm.

Crops sold:
Enter the type of crop sold, its quantity, and the percentages of dry matter, crude protein, P (% dry matter) and K (% dry matter). If a total mixed ration is sold, enter the proportion of the mix which is forage.

Manure, compost and other exports:
Record any other significant products that were sold or given away, such as manure, compost, etc. Enter the quantity, and % solids. Enter the N, P and K on a wet basis as this is the format that compost and manure analysis is commonly reported.