W HOLE F ARM N UTRIENT B ALANCE C ALCULATOR

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Nutrient Management Spear Program

Collaboration among the Cornell University Department of Animal Science, PRODAIRY and Cornell Cooperative Extension

http://nmsp.cals.cornell.edu
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Correct citation:


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Introduction

The purpose of this Microsoft Visual Basic© program is to assist in conducting a mass nutrient balance analysis. This software 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.

Nutrients have four basic fates: 1) they are imported to the farm in purchased products; 2) they are exported from the farm in products sold; 3) they remain on the farm to be recycled; and/or (4) they are lost to the environment. The mass nutrient balance will improve the understanding of nutrient movement onto, within, and away from the farm. A well-managed nutrient management plan may reduce purchased inputs, improve nutrient cycling, and reduce the potential for nutrient loss.

Items Needed to Fill Out Sheets

Items needed to complete the Farm Nutrient Balance Calculator check-in sheet include:

**Contact Screen**
- Producer name, farm name, address, phone, e-mail
- Farm information: balance year, Total Farm acres, All tillable crop and pasture acres, number of acres, perennial and annual with >10% legume, acres receiving manure
- Data collection by: name, e-mail
- Watershed: primary, secondary
- Animal information: milking and dry cows, heifers: 1-2 year, heifers less than one year, calves, bulls and steers, other livestock

**Feed Purchased**
- Inventory, %DM entered as well if you select as fed (AF)
- Yield: tons/acre
- Tons/yr
- % DM, and CP, P and K values as a % of DM
- Feed type: grain, forage or TMR
- % Forage
- Inventories (wet tons)

**Purchased Fertilizers**
- Tons/yr: that have been applied, do not include inventories
- %N, %P₂O₅, %K₂O

**Farm Crop Production**
- % legume (if applicable)
- Acreage grown
- Manure application (yes/no): for legume-containing crops only
- Nutrient Analysis on dry matter (DM) basis: crude protein (CP), phosphorus (P), and potassium (K)
- Feed type or use: forage, grain, or bedding

**Animals Purchased**
- Type (species)
- Description
- Number
- Weight/head (lbs)

**Miscellaneous Purchases**
- Tons/yr
- % DM, and % N, P, and K as % DM
**Milk Sold**
- Milk, lbs/year
- Milk protein (%)

**Animals Sold**
- Type
- Description
- Number
- Weight/head (lbs)

**Crops Sold**
- Tons/yr
- % DM, and CP, P, and K as % DM
- Forage Type: Grain, Forage, TMR
- % Forage

**Other Exports**
- Tons/yr
- % solids
- % wet N, P and K

**Contact Screen**

**Producer Contact Information:**
Record the producer contact information, including address, phone and email (Figure 1).

![Contact Screen](Image)

Figure 1. Contact screen. Here the user enters information such as herd size, farm acres, and watershed.
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, 2008 to December 31, 2008.

Watershed:
Enter the watershed where most of the farm owned and rented land is located in the “Primary” box (see Figure 2). If the farm is in two watersheds, enter the watershed that has the smaller farm area in the “Secondary” box.

Figure 2. New York State Watershed Map.

Farm Information:
Enter the total farm acres (including buildings and woodlands), crop and tillable pasture acres, and the number of acres receiving manure during the balance year. 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, enter groups of heifers on the next 3 lines, bulls and steers on the 4th line and all other livestock on the 5th line. 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.
Farm Crop Production Screen

Enter in relevant information for all crops grown and harvested on the farm, including those used for pasture and bedding (figure 3). 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: 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 next year’s starting inventory. For the Farm Crop Production table, enter values in DM.
- For legume crops enter the percent legume in the stand. If manure was applied to the crop during the balance year, circle or select “Y”.

<table>
<thead>
<tr>
<th>Crop</th>
<th>% Legume</th>
<th>Acres</th>
<th>Manure Applied</th>
<th>CP (%DM)</th>
<th>P (%DM)</th>
<th>K (%DM)</th>
<th>Feed Type</th>
<th>Yield &amp; Inventory Entered as</th>
<th>Yield (t/DA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hay</td>
<td>20</td>
<td>20.0</td>
<td>☐</td>
<td>15.09</td>
<td>1.32</td>
<td>2.00</td>
<td>Forage</td>
<td>Dry, As Fed</td>
<td>2.2</td>
</tr>
<tr>
<td>Silage</td>
<td>0</td>
<td>20.0</td>
<td>☐</td>
<td>9.09</td>
<td>0.21</td>
<td>0.75</td>
<td>Forage</td>
<td>Dry, As Fed</td>
<td>15.0</td>
</tr>
</tbody>
</table>

Figure 3. 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.

**Imports**

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

**Feed Purchases**

In the Feed Purchases screen enter various purchased products used in livestock rations. As with the crop screen, there is already a series of pre-entered common feedstuffs for easy use (figure 4).

- % Forage: for TMRs; 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 is added to purchased concentrates as 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)
Fertilizer Purchases

Enter the amount and analyses of all fertilizers used on the farm (figure 5). Note that, unlike the feed and crop pages, there are no columns for beginning and ending inventories. 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.

Animals Imports Screen

Record the number of adults and young-stock purchased, and the average weight per head in lbs. Select species type from the drop down box (figure 6).
Purchased Bedding and Other Imports

Record the number of tons, % DM, N, P and K (% DM) for all bedding material purchased or other miscellaneous imports. Do not enter farm produced bedding (figure 7).

Exports

Milk Sold

Enter the pounds of milk sold and the % Milk Protein, as listed on milk checks (figure 8). 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.
Animals Exports

Here enter any animals sold throughout the year, including breeding stock, cull or beef cows, etc. (figure 9). This also includes stock that die and are composted or rendered off-farm – do not include animals you compost yourself.

Crop Exports Screen

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 (figure 10).
Manure, Compost, and Other Exports

Here enter any manure or compost that is produced on the farm but sent elsewhere (figure 11). 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.

Generating Reports and Balances

The report menu can be selected from the “Home Menu” by clicking on the “Balance Reports” button (figure 12). There are five reports that may be viewed and printed (figures 13, 14, 15, 16 and 17). 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 12. Home screen after information has been filled out. Now all the buttons are activated.

**Data Entry Report**

The Data Entry report is useful for verifying farm entered data (figure 13).

Figure 13. The Data Entry report is useful for verifying farm entered data.
Annual Nutrient Mass Balance

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) (figure 14). The statistics themselves are displayed three ways, and the balance (imports – exports) is calculated.

![Table of Nutrient Mass Balance](image)

**Figure 14.** The Annual Nutrient Mass Balance is the primary analysis report.

**Output**
- Tons per year: simply gives the absolute amount (in tons) of the given nutrient imported or exported.
- 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). 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.

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.

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 (figure 15). 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.

![Distribution of Nutrient Imports and Exports](image)

Figure 15. The distribution of nutrient imports and exports (%) report.
Itemized Nutrient Imports and Exports (%)

This report more specifically breaks down the sources of nutrients brought in or shipped out (figure 16). The total values are the same as those on the Distribution of Nutrient Imports and Exports report.

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Import % from purchased feed</td>
<td>% N</td>
</tr>
<tr>
<td>Soybean Meal 44</td>
<td>26%</td>
</tr>
<tr>
<td>Brewers Grains-Wet</td>
<td>6%</td>
</tr>
<tr>
<td>Import % from purchased fertilizers</td>
<td>% N</td>
</tr>
<tr>
<td>20-10-10</td>
<td>63%</td>
</tr>
<tr>
<td>Import % from purchased animals</td>
<td>% N</td>
</tr>
<tr>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Import % from miscellaneous imports</td>
<td>% N</td>
</tr>
<tr>
<td>Wheat Straw</td>
<td>3%</td>
</tr>
<tr>
<td>Total Imports</td>
<td>100%</td>
</tr>
</tbody>
</table>

Figure 16. Itemized 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 (figure 17).
<table>
<thead>
<tr>
<th>Itemized N, P, K imports</th>
<th>lbs per tillable acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Import from purchased feed</td>
<td></td>
</tr>
<tr>
<td>Soybean Meal 44</td>
<td>N 24.0</td>
</tr>
<tr>
<td>Brewers Grains-Wet</td>
<td>P 2.1</td>
</tr>
<tr>
<td></td>
<td>K 6.7</td>
</tr>
<tr>
<td>Import from purchased fertilizer</td>
<td></td>
</tr>
<tr>
<td>20-10-10</td>
<td>N 53.3</td>
</tr>
<tr>
<td></td>
<td>P 11.5</td>
</tr>
<tr>
<td></td>
<td>K 22.1</td>
</tr>
<tr>
<td>Import from purchased animals</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N -</td>
</tr>
<tr>
<td></td>
<td>P -</td>
</tr>
<tr>
<td></td>
<td>K -</td>
</tr>
<tr>
<td>Import from miscellaneous imports</td>
<td></td>
</tr>
<tr>
<td>Wheat Straw</td>
<td>N 2.9</td>
</tr>
<tr>
<td></td>
<td>P 0.4</td>
</tr>
<tr>
<td></td>
<td>K 5.7</td>
</tr>
<tr>
<td>Total Imports (lbs/tillable acre)</td>
<td>85.1</td>
</tr>
<tr>
<td></td>
<td>14.8</td>
</tr>
<tr>
<td></td>
<td>35.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Itemized N, P, K exports</th>
<th>lbs per tillable acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Export from milk sales</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N 65.2</td>
</tr>
<tr>
<td></td>
<td>P 10.6</td>
</tr>
<tr>
<td></td>
<td>K 18.8</td>
</tr>
<tr>
<td>Export from crop sales</td>
<td></td>
</tr>
<tr>
<td>Dry Hay</td>
<td>N 0.4</td>
</tr>
<tr>
<td></td>
<td>P 0.1</td>
</tr>
<tr>
<td></td>
<td>K 0.4</td>
</tr>
<tr>
<td>Export from animal sales</td>
<td></td>
</tr>
<tr>
<td>Cull Cows</td>
<td>N 1.4</td>
</tr>
<tr>
<td></td>
<td>P 0.3</td>
</tr>
<tr>
<td></td>
<td>K 0.1</td>
</tr>
<tr>
<td>Export from miscellaneous exports</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N -</td>
</tr>
<tr>
<td></td>
<td>P -</td>
</tr>
<tr>
<td></td>
<td>K -</td>
</tr>
<tr>
<td>Total Exports (lbs/tillable acre)</td>
<td>67.0</td>
</tr>
<tr>
<td></td>
<td>10.9</td>
</tr>
<tr>
<td></td>
<td>19.2</td>
</tr>
</tbody>
</table>

Figure 17. Itemized nutrient imports and exports (lbs per tillable acre) report.
Mass Balance Calculations

Nutrient Imports

Purchased Feed:
- Nitrogen (Tons N / year) =
  Sum of ((tons as-fed purchased + beginning inventory - ending inventory) * % DM * CP concentration)) / 6.25 for each purchased feedstuff.
- Phosphorus (Tons P / year) =
  Sum of ((tons as-fed purchased + beginning inventory - ending inventory) * % DM * % P for each purchased feedstuff.
- Potassium (Tons K / year) =
  Sum of ((tons as-fed purchased + beginning inventory - ending inventory) * % DM * % K for each purchased feedstuff.

Fertilizer:
- Nitrogen (Tons N / year) =
  Sum of (tons fertilizer purchased * % N) for each purchased fertilizer.
- Phosphorus (Tons P / year) =
  Sum of (tons fertilizer purchased * % P_{2}O_{5} * 0.43) for each purchased fertilizer.
- Potassium (Tons K / year) =
  Sum of (tons fertilizer purchased * % K_{2}O * 0.83) for each purchased fertilizer.

Animals Purchased:
- Provided by L. Chase (personal communication, July 6, 2006).

Table 1. Nutrient composition of livestock (N,P,K) as % of bodyweight
<table>
<thead>
<tr>
<th>Species</th>
<th>N</th>
<th>P</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of bodyweight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dairy</td>
<td>2.9</td>
<td>0.70</td>
<td>0.2</td>
</tr>
<tr>
<td>Beef&lt;1000 lbs</td>
<td>2.7</td>
<td>0.73</td>
<td>0.2</td>
</tr>
<tr>
<td>Beef&gt;= 1000 lbs</td>
<td>2.4</td>
<td>0.65</td>
<td>0.2</td>
</tr>
<tr>
<td>Swine&lt;100 lbs</td>
<td>2.5</td>
<td>0.56</td>
<td>0.2</td>
</tr>
<tr>
<td>Swine=&gt;100 lbs</td>
<td>2.4</td>
<td>0.47</td>
<td>0.2</td>
</tr>
<tr>
<td>Poultry</td>
<td>2.8</td>
<td>0.58</td>
<td>0.2</td>
</tr>
<tr>
<td>Goats</td>
<td>2.4</td>
<td>0.60</td>
<td>0.2</td>
</tr>
<tr>
<td>Sheep</td>
<td>2.5</td>
<td>0.60</td>
<td>0.2</td>
</tr>
<tr>
<td>Horses</td>
<td>2.9</td>
<td>0.70</td>
<td>0.2</td>
</tr>
</tbody>
</table>

- Nitrogen (Tons N / year) =
  Sum of (number of animals * average weight in lbs * (N composition/100)) / 2000
- Phosphorus (Tons P / year) =
  Sum of (number of animals * average weight in lbs * (P composition/100)) / 2000
- Potassium (Tons K / year) =
  Sum of (number of animals * average weight in lbs * (K composition/100)) / 2000
**Bedding and Miscellaneous Imports:**

- Nitrogen (Tons N / year) = 
  \[
  \text{Sum of (weight in tons} \times \text{DM} \times \text{% N)}
  \]
- Phosphorus (Tons P / year) = 
  \[
  \text{Sum of (weight in tons} \times \text{DM} \times \text{% P)}
  \]
- Potassium (Tons K / year) = 
  \[
  \text{Sum of (weight in tons} \times \text{DM} \times \text{% K)}
  \]

**Nutrient Exports**

**Milk Sold:**

Milk protein reported to the producer as true protein is converted to crude protein by multiplying by 1.075 (Cornell Animal Science Dept. Mimeo 213). The N content of milk crude protein is calculated by dividing by 6.38.

- Nitrogen (Tons N / year) = \((\text{lbs of milk sold} \times (\text{milk true protein} \times 1.075) / 6.38) / 2000\)
- Phosphorus (Tons P / year) = \((\text{lbs of milk sold} \times 0.0009) / 2000\)


- Potassium (Tons K / year) = \((\text{lbs of milk sold} \times 0.0016) / 2000\)


**Animals Sold:**

See Animals Purchased

**Crops Sold:**

- Nitrogen (tons N / year) = \(\text{Sum of (tons sold} \times \text{DM} \times \text{CP concentration}) / 6.25\)
- Phosphorus (tons P / year) = \(\text{Sum of (tons sold} \times \text{DM} \times \text{phosphorus)}\).
- Potassium (tons K / year) = \(\text{Sum of (tons sold} \times \text{DM} \times \text{potassium)}\)

**Manure, Compost and Other Exports:**

- Nitrogen (tons N / year) = \(\text{Sum of (weight in tons} \times \text{N)}\)
- Phosphorus (tons P / year) = \(\text{Sum of (weight in tons} \times \text{P)}\)
- Potassium (tons K / year) = \(\text{Sum of (weight in tons} \times \text{K)}\)

**Diagnostics**

- Mature Cow = the number of mature cows entered on the Animal Group screen.
- Animal Units = sum of (number of animals \times average weight in pounds) / 1000 for each animal group.
- Ratio of cows to heifers = total number of cows (milking and dry) / total number of heifers.
- Acres receiving manure (% tillable) = (Number of acres receiving manure / total tillable acres) * 100
- Milk production/cow/year (lbs) = Milk Sold / Number of Mature Cows
- Total legume acres = sum of acres entered in Legume Crop Screen
- Animal Density (au/acre)/acres receiving manure = animal units/ acres receiving manure.
- Animal Density (au/acre)/total tillable acres = animal units/ crop+tillable pasture acres.
- Milk Production/manure acre = milk sales in pounds / acres receiving manure.
- Milk Production/tillable acre = milk sales in pounds / crop+tillable pasture acres.
- Purchased Feed (% total feed DM) = total purchased feed DM/total feed DM.
- Total feed dry matter = sum (purchased feed (DM) + legume crops pasture (DM) + non legume farm crop production (DM) – crops sold (DM))
- Total purchased feed (DM) = sum (tons of feed purchased * % DM/100).
- Legume crops pasture (DM) = sum (legume acres * DM yield tons/year)
- Non legume farm crop production (DM) = sum (non legume crop acres * yield ton/acre/year DM)
- Crops sold (DM) = sum (crops sold tons/year * % DM/100)
- Purchased Forage (% total feed DM) = purchased forage DM/total feed DM
- Purchased Forage (DM) = sum (tons of feed purchased * (% dry matter/100) * (% forage/100))
- Purchased Grain (% total feed DM) = purchased grain DM/ total feed DM
- Purchased Grain (DM) = sum (tons of feed purchased * (dry matter % /100) * [1-% forage/100]).
- Farm Produced Feed (% total feed DM) = total farm produced feed/total feed DM
- Farm Produced Forage (% total feed DM) = total farm produced forage/total feed DM
- Farm Produced Grain (% total feed DM) = total farm produced grain/total feed DM
- Farm Produced Feed = sum (legume crops pasture (DM) + non legume farm crop production (DM) – crops sold (DM))
- Farm Produced Forage = sum (legume crops pasture (DM) * (legume crops % forage/100) + non legume farm crop production (DM) * (non legume farm crop production % forage /100) – crops sold (DM) * (crops sold % forage/100))
- Farm Produced Grain = sum (legume crops pasture (DM) * (1-(legume crops % forage/100)) + non legume farm crop production (DM) * (1-(non legume farm crop production % forage /100)) – crops sold (DM) * (1-(crops sold % forage/100)))

**Nutrients Remaining**
- Per animal unit (lbs) N, P and K = (Tons N, P or K * 2000)/ animal units
- Per mature cow (lbs) N, P and K = (Tons N, P or K * 2000)/ mature cow
- % = [ (Imports-Exports) / Imports]

**Production Efficiency**
- Feed Use Efficiency (Milk / Feed) N, P and K % = [(Tons N, P or K milk sold) / (Tons N, P or K farm produced + Tons N, P or K purchased)] * 100.
- Nutrients (N, P or K) imported per cwt milk sold = [Total Lbs N, P or K imported / (Lbs Milk N, P or K / 100)]
Nutrients remaining per cwt milk sold = \[(\text{Total Lbs N, P or K imported} - \text{Total Lbs N, P or K exported}) / (\text{Lbs Milk N, P or K} / 100)\]

**Other Nitrogen Contributions**

- **Legume N Fixation:**
  For each legume crop or pasture, N Fixation (tons N/year) =
  - If legume % >90%: \((0.6 \times \text{acres produced} \times \text{DM yield} \times \text{average CP content})/6.25\)
  - If legume % = 90% or less: \((0.36 \times \text{acres produced} \times \text{DM yield} \times \text{average CP content})/6.25\)

- **Atmospheric N Deposition:**
  Atmospheric nitrogen deposition is estimated at 8 lbs N per total farm acre (tillable and non-tillable) per year: Atmospheric N Deposition (tons N/year) = total farm acres \(\times\) 8


- Total other N imports (tons) = Legume N fixation + Atmospheric N Deposition.
- Total N remaining = N imported (feed, fertilizer, animals purchased and miscellaneous) - N exported (milk, animals sold, crops sold, miscellaneous) - total other N imports (legume N fixation, atmospheric N deposition)
- Total N remaining/au (lbs) = total N remaining / animal units
- Total N remaining/cow (lbs) = total N remaining / mature cows
- % Total N remaining = total N remaining / total N imported \(\times\) 100

**Exporting Data to Cornell Nutrient Management Spear Program**

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. When Cornell receives your data, it can be merged with the database of all farms participating in the study since 2005. You will receive a individual letter analyzing your data in comparison to previous years that you have participated (appendix 1). At the end of the data collection period, you will also receive an extensive report that compares your nutrient mass balance to all other farms submitting data for that balance year (appendix 2).

To export the data to Cornell, on the home menu 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 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.

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 Quirine Ketterings (qmk2@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 18).
Figure 18. 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.

Appendix

Appendix 1: Individual homework farm letter

Appendix 2: Comparison homework farm letter