The Value of Solid Beef Feedlot Manure for Corn Production in North Dakota

About the Spreadsheet

- Please "Enable Active Content" (Microsoft Excel disables those functions as default) on Microsoft Excel so the calculator can perform as expected.
- The fields highlighted in light blue throughout the spreadsheets are customizable and the user should add/change the values on those cells to reflect the values of his/her operation.
- The goal of this spreadsheet is to serve as a tool for farmers/producers to assess the nutrient value of manure when compared to different sources of nitrogen (N) and phosphorus (P) commercial fertilizers. When calculated, the manure’s nutrient value takes into consideration the cost per unit of nutrient (lb.) in each commercial N and P fertilizer selected by the user in the spreadsheet and in the cost per unit of K₂O in the form of 00-00-60 (Muriate of Potash) fertilizer. Therefore, every time the user changes the source of N and P to be used on his/her operation, the application rates and costs associated with those rates will be automatically calculated.
- On the Calculator home screen, the user can select if the manure is going to be applied to meet "Nitrogen Crop Requirements" or "Phosphorus Crop Requirements". When applying manure to meet “Nitrogen Crop Requirements”, the spreadsheet calculates the "Application Rate" (line 7.6) that will supply the total amount of N recommended for corn (Line 6). The user can choose an "Actual Manure Application Rate" (Line 7.7), and if it is smaller than the "Application Rate" (Line 6) the calculator will automatically calculate "Nutrients Balance" (Line 7.4 - a negative numbers means that there is a deficit of nutrients) and the "Commercial Fertilizer Application Rates" (Line 7.5) necessary to supply the nutrients in deficit from Line 7.4 to reach the nutrient recommendations listed on Line 6, as well the cost associated with those application rates (Line 9.1 under the “Manure” column).
- This calculator does not have the intention of competing with or to be a substitute for the "North Dakota Corn Nitrogen Calculator", updated and released in 2014 by Dr. Dave Franzen (NDSU Soil Extension Specialist). For that reason, the user should click on the hyperlink provided on the spreadsheet and visit the website that hosts the "North Dakota Corn Nitrogen Calculator" to determine the N recommendation that fits his/her operation, and then enter that number on line 9 (Nutrient Recommendation), under the Nitrogen column. The nutrient recommendations for P and K are calculated according with the equations presented for corn in the publication SF-882 (Revised) (North Dakota Fertilizer Recommendations Tables and Equations).
- Once the user enters all the values for his/her operation, the calculator can be used to determine the hauling distance (Line 7.10) limit that allows one to remain profitable when applying manure.
- The calculator has an option to perform the calculations using average values for manure nutrient content. As the amount of nutrients in manure shows great variability, it is strongly recommended that farmer/producers have an analysis report for the manure that they are planning to apply on their fields. For that reason, the default option selected for the question "Do you have a manure analysis report?" is "YES" (Lines 5 and 6 in the furthest right column).

**Spreadsheet Content**

**General Information**
General information about the user's field (ID, area), soil (nutrient content) and yield potential.

**Manure Incorporation - Please Select One**
The amount of the Ammonium-N that will be available for the crop is affected the number of the days that the manure remains in the soil surface without being incorporated. Select an incorporation time that will fit your operation. This choice will be reflected on the Nutrient Availability Factor (Line 7.1) and on the amount of N that will be available from manure to the crop (Line 7.2).

**Nitrogen Source - Please Select One**
Select from the dropdown list the N fertilizer you will be using on your operation. When a new source of N is selected, the spreadsheet automatically recalculates a series of new values associated with the N content and the cost of the new N source selected.

**Phosphorus Source - Please Select One**
Select from the dropdown list the P fertilizer you will be using on your operation. When a new source of P is selected, the spreadsheet automatically recalculates a series of new values associated with the P and N content and the cost of the new P source selected.

**Do you have a manure analysis report?**
If "YES" is selected, the user will be asked to enter the values for Ammonium-N, Organic-N, P₂O₅ and K₂O (all in lbs./ton) on line 7. If "NO" is selected, all the calculations will be done using average nutrient values for manure and the user will see the following note on the line under “NO”: "Average nutrient values for manure being used".

**Fertilizer (Sources and Prices)**
The N and P fertilizer sources listed on both spreadsheets are the ones most commonly used for crop production in North Dakota. The fertilizer prices listed in the spreadsheet ($/ton) are the prices listed for April 2014 by the USDA, National Agricultural Statistics Service.

**Manure Nutrient Content (Line 7)**
This refers to the nutrient content listed on your Manure Analysis Report. Make sure to use the values are listed as lbs./ton.

**Manure - Actual Application Rate (Line 7.7 - Nitrogen Spreadsheet)**
On Line 7.6, there is the calculated "Application Rate" that will supply all of the N required by the crop. If manure is the only source of N to be used, the values on Lines 7.6 and 7.7 should be the same. If the value on Line 7.7 is smaller than the one on Line 7.6, the amount of manure to be applied will not be enough to supply all of the N required by the corn. So, some extra N has to be supplied as commercial fertilizer. The amount of nutrient will be shown at line 7.4 (Nutrients Balance), as a negative number, and the fertilizer rate will be shown on line 7.5 (this will change according to the N source selected).

**Commercial Fertilizer (Line 8)**
Calculates the commercial fertilizer needs for corn based on the sources of nutrients selected. There are more options for P fertilizer on the spreadsheet that is used to calculate the value of manure based on "Phosphorus Crop Requirements" because of the focus of each spreadsheet.

**Costs (Line 9)**
As explained in the section "About the Spreadsheet", the value of manure as a fertilizer is based on the cost per unit of N or P in the different fertilizers selected by the user. With that in mind, if the user compares the price of N ($/ac, Line 9.1, Nitrogen spreadsheet) for Manure and Fertilizer they should be the same, even though the application rates are very different. That will hold true if the other sources of nutrients (P and K) are free of N. The most commonly used source of P fertilizer in ND is 11-52-00, which contain 11% of N. So, that N should be accounted for in the balance of nutrients. For that reason, the farmer/producer gets some of N from the P fertilizer, the cost of N as fertilizer is a little less than the cost of N as manure per acre. When applying commercial fertilizer producers have additional costs associated with P2O5 and K2O as well. When manure is applied based on the nitrogen crop requirements, the amounts of P2O5 and K2O applied are enough to supply the corn requirements for those nutrients for 2-3 years. So, there is no cost associated with P2O5 and K2O on that situation, but there is an “Additional Nutrient Value” (Lines 10.2 and 10.3) associated with that extra amount of nutrients being applied, plus the value of N available on the second year manure application (Line 10.1)
When applying manure based on "Phosphorus Crop Requirements", the application rates are lower than when applying based on "Nitrogen Crop Requirements". That rate will provide the total amount of P required by the crop, some of the N and some or all of the K required. In that case, there are costs associated with N, P and K for both Manure and Fertilizer, but the costs associated with manure are lower due to additional nutrients, other than P, present in the manure.

**Additional Nutrient Value (Line 10)**

The additional value in terms of nutrients (based on the cost of N, P and K commercial fertilizers) that the farmer/producer gains by using manure or commercial fertilizer as a source of N or P. The additional nutrient value for manure takes into consideration that: a)15% of the organic N present in the manure will be available for the second year; and b) the value of the nutrients that are applied as manure in addition to your nutrient target (N or P). For a commercial fertilizer (11-52-00 being used as P source, for example), the additional nutrient value for N is considered the amount of that nutrient that is applied with the recommended fertilizer application rate.

**Cash Balance (Lines 11 and 12)**

The “Net Cash Balance for the Whole Field when Applying Manure” (Line 12) is calculated by the following expression: (Fertilizer Total Cost for the Whole Field)-(Manure Total Cost for the Whole Field)+(Manure Additional Nutrient Value)-(Fertilizer Additional Nutrient Value). The Net Cash Balance per acre (Line 11) is calculated by dividing Line 12 by the number of acres on that field (Line 2).