# Determining Nutrient Content of Land Applied Milk-Manure Mixtures

**Overview:** This technical guidance is considered an emergency response due to the COVID-19 event; it is neither offered nor approved for normal, everyday business practice. This planning tool will determine nutrients available for crops from milk and milk-manure solutions. The N-P-K values for liquid dairy manure and milk are based on nutrient values developed by Penn State. Milk and manure have different nitrogen availability factors, the nitrogen in milk is considered to be 100% available. The manure will have a nitrogen availability factor ranging from 20 to50% based on incorporation timing.

Table 1 shows the N-P-K nutrient content per 1000 gallon of Milk-Manure Mixtures in various concentrations and based on different incorporation timings.

**Table 1**

**Milk in Manure Nutrient Content Chart**

| Component | Nutrient Content (pounds per 1000 gallons) Book Values | | | | |
|---|---|---|---|---|---|
| | N | $P_2O_5$ | $K_2O$ | | |
| Milk Nutrient Content | 44 | 18 | 15 | | |
| Dairy Liquid Manure Nutrient Content | 28 | 13 | 25 | | |
| | Manure Incorporation Timing and Nitrogen Availability | | | | |
| Manure Total Nitrogen Availability Factor | Same day | Within 1 day | 2-4 days | 5-7 days | >7 days |
| | 0.50 | 0.40 | 0.35 | 0.30 | 0.20 |

| Milk-Manure Mixture | | Available pounds Nitrogen /1000 gallons Milk-Manure Mix | | | | | Pounds $P_2O_5$ / 1000gal Milk-Manure Mix | Pounds $K_2O$ / 1000 gal Milk-Manure Mix |
|---|---|---|---|---|---|---|---|---|
| | | Manure Incorporation Timing and Nitrogen availability | | | | | | |
| % Milk | % Manure | Same day 0.50 | Within 1 day 0.40 | 2-4 days 0.35 | 5-7 days 0.30 | >7 days 0.20 | | |
| 10 | 90 | 17 | 14 | 13 | 12 | 9 | 14 | 24 |
| 20 | 80 | 20 | 18 | 17 | 16 | 13 | 14 | 23 |
| 30 | 70 | 23 | 21 | 20 | 19 | 17 | 15 | 22 |
| 40 | 60 | 26 | 24 | 23 | 23 | 21 | 15 | 21 |
| 50 | 50 | 29 | 28 | 27 | 26 | 25 | 16 | 20 |
| 60 | 40 | 32 | 31 | 30 | 30 | 29 | 16 | 19 |
| 70 | 30 | 35 | 34 | 34 | 33 | 32 | 17 | 18 |
| 80 | 20 | 38 | 37 | 37 | 37 | 36 | 17 | 17 |
| 90 | 10 | 41 | 41 | 41 | 40 | 40 | 18 | 16 |
| 100 | 0 | 44 | 44 | 44 | 44 | 44 | 18 | 15 |

The nutrient available are determined using the following calculations:

Nitrogen Calculation:

$$\left(\frac{Percent\ Milk}{100}\ X\ Nitrogen\ in\ Milk\right)+\left(\frac{Percent\ Manure}{100}\ X\ Nitrogen\ in\ Manure\ X\ N\ Availability\ Factor\right)=Available\ \frac{Nitrogen}{1000\ gallons}$$

Phosphate Calculation:

$$\left(\frac{Percent\ Milk}{100}\ X\ P2O5\ in\ Milk\right)+\left(\frac{Percent\ Manure}{100}\ X\ P2O5\ in\ Manure\right)=\frac{P2O5}{1000\ gallons}$$

Potash Calculation:

$$\left(\frac{Percent\ Milk}{100}\ X\ K2O\ in\ Milk\right)+\left(\frac{Percent\ Manure}{100}\ X\ K2O\ in\ Manure\right)=\frac{K2O}{1000\ gallons}$$

A planning tool has been developed to simplify the record keeping process of land applying milk and tracking the nutrients applied at a given application rate. The nutrients values applied can be added to a Nutrient Management Plan (NMP) or Nutrient Balance Sheet (NBS) in the starter or other nutrients applied column. This will provide the information needed to adjust the manure application rates planned separately from the milk or milk-manure mixture.

Complete the yellow cells below. Enter the Field Id to receive the manure. Select the percent milk-manure solution from the drop-down list that most closely represents your scenario. Selections are available from 10% milk-manure solution to 100% milk. Select the days to incorporation from the drop-down list. Enter the application rate in Gallons/Acre. This information will provide the total N-P-K nutrients applied. The values can be entered in a Nutrient Management Plan or Nutrient Balance Sheet as starter or other fertilizer to account for the nutrients applied from land application of milk or milk-manure mixture. It is recommend to print and save this for your records.

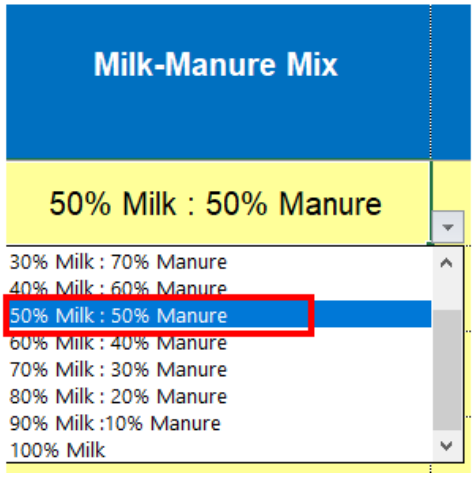
**Instructions**:

**1.** Enter the Field Id to receive the manure

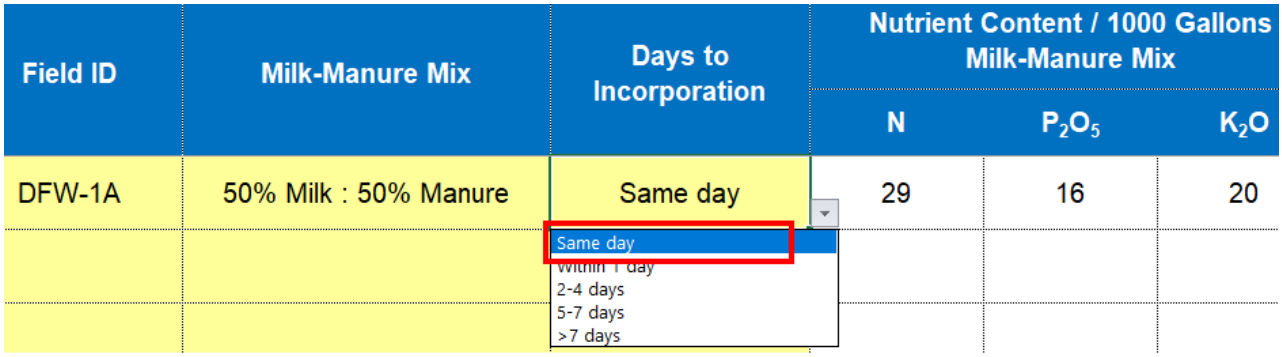
| Field ID | Milk-Manure Solution | Days to Incorporation | Nutrient Content / 1000 Gallons | | | Application Rate Gallons/Acre | Total Nutrients Applied | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | N | $P_2O_5$ | $K_2O$ | | lbs. N | lbs. $P_2O_5$ | lbs. $K_2O$ |
| DFW-1A | | | | | | 2,000 | | | |
| | | | | | | | | | |
| | | | | | | | | | |

Manure-Milk Nutrient Calculator

2. Select the percent milk-manure solution from the drop-down list that most closely represents your scenario. Selections are available from 10% milk-manure solution to 100% milk.




3. Select the days to incorporation from the drop-down list and the nutrient content of the Milk-Manure mix will be calculated.




4. Enter the application rate in Gallons/Acre. The total nutrients applied at the stated application rate will be listed.

| Field ID | Milk-Manure Mix | Days to Incorporation | Nutrient Content / 1000 Gallons Milk-Manure Mix | | | Application Rate Gallons/Acre | Total Nutrients Applied | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | N | $P_2O_5$ | $K_2O$ | | lbs. N | lbs. $P_2O_5$ | lbs. $K_2O$ |
| DFW-1A | 50% Milk : 50% Manure | Same day | 29 | 16 | 20 | 3,000 | 87 | 47 | 60 |

**5.** This information will provide the total N-P-K nutrients applied values can be entered as starter or other fertilizer to account for the nutrients applied from land application of milk in a NMP or NBS.

NBS Example:

| **Option 1 P Removal<br>Option 2 Nitrogen Based<br>Nutrient Balance Sheets** | Corn Grain<br>Milk Land Applied<br>Dairy Liq. Spring | | |
|---|---|---|---|
| Crop Group Identification | | | |
| Fields | DFW-1A | | |
| Acres | 10 | | |
| NBS Option | Option 2 Nitrogen Requirement | | |
| Mehlich 3 Soil Test P<br>For Option 2 enter maximum Soil Test<br>For Option 3 enter soil test for PI | ppm P<br>121 | | |
| P Index Part A Evaluation | | | |
| Part A Result | | | |
| Crop | Corn for Grain | | |
| Planned Yield | 180 bu/A | | |
| Crop Removal Recommendations (lb/A) | **N**<br>180 | **P2O5**<br>72 | **K2O**<br>54 |
| Soil Test Recommendation (lb/A) | | | |
| Other Nutrients Applied (lb/A)<br>(Nutrients applied regardless of manure) | 87 | 47 | 60 |
| P Index Application Method | | | |
| Double Crop Carry Over N (lb/A) | 0 | | |
| Manure History Description<br>Residual Manure N (lb/A) | 20 | Frequently - Summer Crop | |
| Legume History Description<br>Residual Legume N (lb/A) | 0 | No Previous Year Legume | |
| Net Nutrients Required (lb/A) | 73 | 25 | -6 |
| Manure Group | Liquid Dairy | | |
| Units | lb/1000 gal | | |
| Manure Nutrient Content<br>(lbs/ton or 1000 gal) | **N**<br>28.00 | **P2O5**<br>13.00 | **K20**<br>25.00 |
| Application Season: Management<br>(Incorporation, cover crops, etc.) | Spring: Spring or summer utilization-Incorporation after 7 days or none | | |
| Availability Factors<br>(Total N or NH4-N & Organic N) | **Total N**<br>0.20 | **NH4-N** | **Org. N** |
| P Index Application Method | | | |
| N Balanced Manure Rate (ton; gal/A) | 13,036 gal/A | | |
| P Removal Balance Manure Rate<br>(ton or gal/A; If required by P Index) | 1,923 gal/A<br>Crop P Removal (lb/A) 25.0 | | |
| P Index Value | | | |
| Planned Manure Rate (ton or gal/A) | **5000 gal/A** | | |
| Nutrients Applied at Planned Manure Rate (lb/A) | 28 | 65 | 125 |
| Nutrient Balance after Manure | 45 | -40 | -131 |
| Supplemental Fertilizer (lb/A) | 45 | 0 | 0 |
| P Index Application Method | | | |
| Final Nutrient Balance (lb/A) | **0** | **-40** | **-131** |
| Multiple Application | | | |

Land applied milk-manure nutrients added as other nutrients applied

**Developed by Penn State Extension and the Pennsylvania State Conservation Commission**
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