AW93-011

# Nutrient Management for Dairy Production

FACT SHEET 2

## Nitrogen Requirement of Silage Corn

Manure Nutrient Value and Application, Fact Sheet 1, presents an evaluation of manure nutrient content and calculations of manure application rates. Calculation of the nitrogen needed to produce a silage corn crop is the next step. The approach used here is a nitrogen budget. The nitrogen budget attempts to balance crop requirements with nutrient inputs. Using this approach, an estimate of manure application rate can be calculated. Your goal is to plan manure and nutrient distribution for the upcoming season, minimizing nutrient surpluses or shortages.

### Nitrogen (N) Budget for Field Corn

Fertilizer N Requirement = (Corn N Uptake) – (N supplied by soil)

The first step in using a nitrogen budget or any other approach to fertilization is to set realistic yield goals. Yield goals should be based on experience and records kept for the field being managed. A field is able to produce a set amount of corn. Fertilizing for a yield goal above the field's capability will not increase yields, but will increase inputs and expenses. Yield goals should not be the highest yield ever produced on the field, but should be an average yield from "good" years.

*Enter your yield goal here*: _____ tons/acre

After a yield goal is set, you are ready to calculate corn N uptake. Corn N uptake is the amount of nitrogen removed from the soil by the crop. We can calculate corn N uptake if we know

- yield
- moisture content
- protein content

**Step 1.** Calculate dry matter (DM) yield for a field that produces 20 t/a silage at 70% mositure. Use the following formula:

DM yield = [silage yield x % DM] ÷ 100

Silage yield = 20 tons silage/a x 2,000 lb/t = 40,000 lb silage/a

Dry matter percent = 100 – 70% moisture = 30% DM

DM yield = [(40,000 lb silage/a) x (30% DM)] ÷ 100

= 12,000 lb dry matter/a

Calculate your estimated dry matter yield after choosing a yield goal or use actual production figures:

Yield goal = ____tons silage/a x 2,000 lb/t = ____ lb silage

Dry matter percent = 100 – ____% moisture = ____% DM

DM yield = [( _____lb silage/a) x ( ___% DM)] ÷ 100

= _____ lb dry matter/a

**Step 2.** Calculate percent nitrogen (N) in silage. Percent N can be determined from percent protein.

Percent N = Percent Protein ÷ 6.25

*Example:* Calculate the percent N if the silage is 8% protein.

8% ÷ 6.25 = 1.28 % N

Calculate your percent N.

Percent protein: _____

(% protein) _____ ÷ 6.25 = _____ % N

**Step 3.** Calculate Corn N Uptake

Corn N uptake = (dry matter yield x % nitrogen) ÷ 100

*Example:* For the above yield goal of 20 t/a silage at 70% moisture and 8% protein:

Corn N Uptake = (12,000 lb DM/a x 1.28 percent N)

÷ 100 = 154 N lb/a

Calculate Corn N uptake for your crop

Corn N Uptake = (____DM lb/a x ____percent N)

÷ 100 = _____ N lb/a

An estimate of corn N uptake can be made. Corn silage at 70% moisture contains approximately 8 lb N/t silage. Multiply 8 lb N/t by your yield goal for an estimate of silage corn N uptake.

Use Fact Sheet 1 to calculate the manure application rate to supply the nitrogen needed by the corn crop. The nutrient budget approach provides an estimate of the manure needed to supply a silage corn crop. The next sections discuss several methods of monitoring field conditions to refine nitrogen management. The methods discussed can aid in reducing commercial fertilizer use while maintaining yields.

## Tools for refining N management

By using an in-season soil test and tissue test at harvest, adjustments can be made in the budget to reduce nutrient surpluses or deficits.

### Pre-side dress Soil Nitrate Test (PSNT)

The PSNT is an in-season soil test that can result in substantial savings of fertilizer dollars. The PSNT is used to measure soil nitrate before the period of rapid crop uptake. For corn, this means sampling when plants are about 12 inches tall. By sampling in season as opposed to pre-plant, nitrogen that has become available as a result of mineralization of organic matter during the late spring and early summer can be measured. The concept is illustrated in Figure 1. Some of the guess work in the original nitrogen budget is eliminated by using the PSNT.

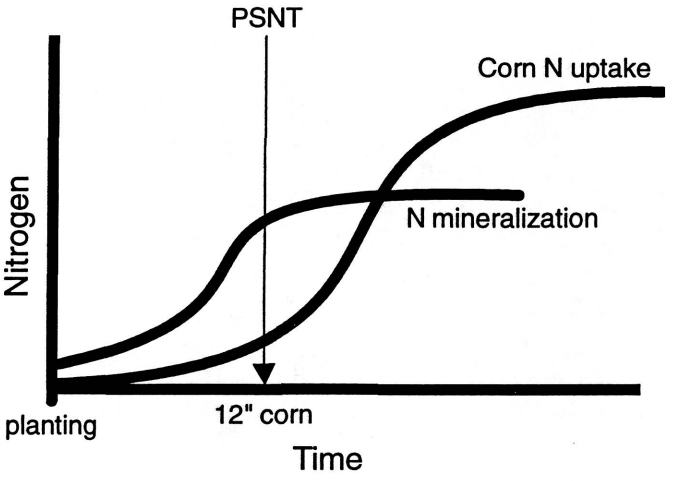


**Figure 1.** The relationship of nitrogen mineralization and corn nitrogen uptake is well suited for an in-season nitrogen soil test.

Follow these steps to use the PSNT.

- If needed, apply a minimum of starter N (30-40 lb N/a) in spring.
- Sample soil to a depth of 12 inches when corn is 12 inches tall, or at least a week before planned sidedressing. Sample from between the rows, avoiding fertilizer bands. Make a composite sample from 15-20 cores.
- Dry soil sample or deliver it to a laboratory immediately. Changes in nitrate can occur rapidly if the sample is not dried.
- Analyze soil sample for $NO_3$-N. A list of laboratories is found in FG 74, *Analytical Laboratories Serving Oregon.* See "For More Information" section.
- If soil $NO_3$-N concentrations are above 25 ppm, no additional N fertilizer is needed.
- If soil $NO_3$-N concentrations are below 25 ppm, apply sidedress N fertilizer.

## "Report card" soil testing

Report card soil tests are performed *after* the crop has been harvested. These fall tests allow for evaluation of the previous spring's nutrient budget. If soil nutrient concentrations after harvest are high, reductions in fertilizer applications may be possible the following year. For example, a report card soil test shows 100 lb/a nitrate nitrogen remaining in the surface foot of soil after harvest. This amount of residual nitrate indicates nitrogen was supplied in excess of crop needs. The extra nitrogen may have come from mineralization of organic matter in the soil or inaccuracies in predicting the amount of nitrogen supplied by manure. An end of season or report card soil test may help in making the decision to apply less fertilizer the following year.

## Report card soil test

- Sample soil to a depth of 12" as described for PSNT sampling. Sample from between rows, avoiding fertilizer bands.
- Handle sample as described for PSNT sampling.
- Analyze sample for nitrate nitrogen ($NO_3$-N).
- If soil $NO_3$-N test results are above **15 ppm**, then nitrogen was most likely supplied in excess of crop needs. (To convert ppm to lb/a, multiply by 3.65).

## Corn stalk nitrate testing

Corn stalk nitrate testing is performed at harvest, and is used to evaluate nitrogen management of the mature crop. Similar to report card soil testing, stalk nitrate testing occurs too late to make adjustments in the current year's management but can aid in making decisions regarding nitrogen applications in future years. The method for corn stalk nitrate testing is as follows:

- Collect ten mature corn plants by cutting the stalks just above the brace roots. Select representative plants away from edges of the field.
- Cut an 8-inch section of stalk from the bottom of each harvested plant.
- Remove the dried outer leaves from each 8-inch section.
- Split each section of stalk lengthwise to aid in drying.
- Place the split stalks together in a bag and send to a lab for nitrate nitrogen ($NO_3$-N) analysis.
- If stalk $NO_3$-N concentrations are above **4000 ppm** on a dry matter basis, then nitrogen was most likely supplied in excess of crop needs.

## For more information

To order FG 74, *Analytical Laboratories Serving Oregon* write Publication Orders, Agricultural Communications, Oregon State University, Administrative Services A422, Corvallis, OR 97331-2119. There is no charge for this publication.

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