



## N Guidelines for Corn

With increasing fertilizer prices and concerns about nutrient losses to the environment, it is especially important to account for all nutrient sources when determining the optimum nitrogen (N) application rate for corn.

Recommendations for phosphorus (P), potassium (K) and other nutrients are derived from soil tests. However, in the humid climate of the Northeastern US, it is difficult to base N guidelines on soil nitrate because soil nitrate levels change rapidly depending on rainfall and temperature. Instead, Cornell N guidelines for corn consider soil specific yield potentials (YP in bushels/acre), annual N contribution from the soil organic matter (SoilN in lbs N/acre), N release from a decomposing sod (SodN in lbs N/acre), and soil specific fertilizer N uptake efficiency (Neff as a percentage):

$$\text{Recommended N} = \frac{(\text{YP} * 1.2 - \text{SoilN} - \text{SodN})}{(\text{Neff} / 100)}$$

In this fact sheet we describe each of these inputs, identify where you can find the necessary information, and show some example calculations.

### Yield Potential (YP)

Yield potential is defined as the expected yield over 3-4 of 5 years under good management. Corn yield potentials have been derived for all agricultural soils in New York and are updated as new research is conducted. Yield potentials are drainage dependent, reflecting different yields under drained and undrained conditions for soils that are, by nature, poorly drained. A few examples for New York soils are given in Table 1.

Table 1: Examples of corn yield potentials (YP) for New York soils.

Soil type	Corn yield potential	
	Undrained	Drained
	bushels per acre	bushels per acre
Howard	135	135
Hamlin	155	155
Volusia	95	105
Rhinebeck	105	120

Yield potentials can be looked up in Appendix 1 of the Nitrogen Guidelines for Field Crops in New York (see additional resources). They are given in bushels/acre (85%DM). To convert to the equivalent yield as silage (35% DM), divide grain yield by 5.9 bu/ton. Use a local soil survey to determine the soil type.

### Soil Nitrogen (SoilN)

Soil N availability through mineralization of soil organic matter is a function of soil type and artificial drainage class. Look-up tables exist that show estimates of SoilN under undrained (UD) and under excellent artificial drainage conditions (see Appendix 1 of the Nitrogen Guidelines for Field Crops in New York).

Table 2: Examples of soil N contributions for New York soils.

Soil type	Soil N supply (SoilN)	
	Undrained	Drained
	lbs per acre	lbs per acre
Howard	70	70
Hamlin	80	80
Volusia	60	70
Rhinebeck	65	75

### Sod Nitrogen (SodN)

Sods provide a substantial amount of N for three years following plow down. When the sod is killed, the organic N will become available through mineralization. The amount of N available is a function of the sod density and quality, the percent of legume, and time since the sod crop was plowed or killed. The amount of N available from different sods can be estimated using Table 3.

Table 3: Sod N release rates.

Legume in sod (%)	Available N			
	Total N pool	Yr 1*	Yr 2	Yr 3
	lbs per acre			
0	150	83	18	8
1-25	200	110	24	10
26-50	250	138	30	13
50 or more	300	165	36	15

\* First year following plow down.

For more information on accounting for sod N contributions see fact sheet #21 (Nitrogen needs for first year corn).

### Soil N Uptake Efficiency (Neff)

The percentage of applied fertilizer that can become part of the plant is called the uptake efficiency. Plants are not able to take up 100% of the inorganic N supplied to the soil. Sidedress applications of fertilizer and inorganic N from manure can be high (if applied at the right amount) but usually efficiencies for NY soils range from 50 to 75%. Nitrogen uptake efficiency data can be found in Nitrogen Guidelines for Field Crops in New York (see additional resources below).

Table 4: Examples of soil N uptake efficiencies.

Soil type	N uptake efficiency (Neff)	
	Undrained	Drained
	%	%
Howard	75	75
Hamlin	75	75
Volusia	60	65
Rhinebeck	60	65

### Other Factors

- The N requirement for corn in a no-till system is increased 10 lbs/acre due to slower soil warming in the spring.
- The N requirement of corn grown on muck soils is 95 lbs per acre.

### Example Calculations

Using the information presented above, N recommendations can be calculated for a second year corn crop in an undrained, Hamlin soil in continuous corn:

$$[(155 * 1.2) - 80 - 0] / (75/100) = 141 \text{ lbs N per acre}$$

Another example is the N recommendation for a third year corn following a 50% alfalfa sod on a drained Volusia soil:

$$[(120 * 1.2) - 70 - 13] / (65/100) = 94 \text{ lbs N per acre}$$

Both fields require additional fertilization with either manure or chemical fertilizers or a combination. When calculated N needs are zero (or negative) and no manure has been applied, a starter fertilizer is recommended at a rate of 10-30 lbs per acre (fact sheet #21).

### Manure N Credits

After calculating the N recommendation for a field, N supplies from manure applications in the three previous years must be accounted for and subtracted from the N recommendations. More information on how to account for manure N credits can be found in fact sheet #4 (Nitrogen credits from manure).

### Software and Calculators

Tools have been developed to estimate N contributions without having to go through the calculations. An on-line calculator can be used that also incorporates residual manure N and current year manure N (refer to additional resources below for web address). The results can be used to identify additional fertilizers that may need to be purchased or N surpluses on a field.

Cropware, a comprehensive nutrient management software, can provide automatic calculations of N, P and K recommendations for numerous crops. The software can be downloaded, free of charge, from the website listed below.

### Additional Resources

- o Nutrient Management Spear Program Agronomy Fact Sheet Series: <http://nmsp.css.cornell.edu>
- o Nutrient Guidelines for Field Crops in New York: [http://nmsp.css.cornell.edu/nutrient\\_guidelines/](http://nmsp.css.cornell.edu/nutrient_guidelines/)
- o Cropware: A tool for nutrient management planning: <http://nmsp.css.cornell.edu/software/cropware.asp>
- o NYS Corn Nitrogen Calculator: [http://nmsp.css.cornell.edu/nutrient\\_guidelines/](http://nmsp.css.cornell.edu/nutrient_guidelines/)

### 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



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