Potassium Guidelines for Corn

After nitrogen and phosphorus, potassium (K) is the nutrient most likely to limit plant growth. Potassium is needed for energy metabolism, starch synthesis, photosynthesis, nitrogen fixation, and sugar degradation. Potassium is not currently considered a threat to water quality; however, K fertility management is important because (1) plants with optimum K levels are more resistant to environmental stresses, including drought, and (2) high levels of K in feed can cause milk fever in pregnant dry cows. In this fact sheet, we outline the potassium guidelines for corn.

Potassium Forms and Availability

Soil K can be divided into three major pools of plant availability: (1) soil mineral K (2) fixed K, and (3) soil solution and exchangeable K. Soil mineral K is not available for plant uptake, but over time, soil minerals break down, releasing K to the soil solution. Fixed K is part of the internal structure of clay minerals of the soil. This pool is slowly available for plant uptake over time. The total amount of K in solution is relatively small (one or two percent of the total amount of K in the soil). This pool of K is directly available for plant uptake and resupplied by exchangeable K. Much of the K required for crop production comes from K in solution and exchangeable K. These pools are also reflected in the agronomic soil test.

Potassium is a positively charged ion (cation). It does not readily leach because of its attraction to the soil's negative charge; however, K can leach in very sandy soils with a low cation exchange capacity. Some K may also be returned to the soil as a result of leaching from plant foliage by rainwater or irrigation.

Potassium Supply of New York Soils

New York State agricultural soils are divided into five mineral soil management groups and a sixth group consisting of organic (muck) soils (see Table 1 and Agronomy Fact Sheet #19). The five mineral groups are classified according to texture of the surface and subsoil and parent material (lake sediments, calcareous glacial till, glacial outwash and recent alluvium). There is a good correlation between soil management group and native K supply, and this is reflected in the soil test interpretations (Table 2) and the guidelines for applying K to corn (Table 3).

Table 1: Soil management groups (SMG) for New York State agricultural soils.

SMG	General Description
1	Fine-textured soils developed from clayey lake sediments and medium- to fine-textured soils developed from lake sediments.
2	Medium- to fine-textured soils developed from calcareous glacial till, medium-textured to moderately fine-textured soils developed from slightly calcareous glacial till mixed with shale, and medium-textured soils developed in recent alluvium.
3	Moderately coarse-textured soils developed from glacial outwash and recent alluvium and medium-textured acid soils with fragipans developed on glacial till.
4	Coarse- to medium-textured soils formed from glacial till or outwash.
5	Coarse-textured to very coarse-textured soils formed from gravelly or sandy glacial outwash or glacial lake beach ridges or deltas.
6	Organic or muck soils with more than 80% organic matter.

Modified from: Cornell Field Crops and Soils Handbook, Cornell Cooperative Extension (1987).

Figure 1: Potassium deficiency symptoms of corn (Photo courtesy of Department of Soil Science, University of Wisconsin).

Table 2: Interpretations of Cornell Morgan soil test K data.

SMG	Soil test K				
	Very Low	Low	Medium	High	Very High
	-------lbs K/acre (CNAL Morgan extraction)--------				
1	<35	35-64	65-94	95-149	>149
2	<40	40-69	70-99	100-164	>164
3	<45	45-79	80-119	120-199	>199
4	<55	55-99	100-149	150-239	>239
5/6	<60	60-114	115-164	165-269	>269

Guidelines for Applying Potassium to Corn

Potassium fertilizer guidelines for corn are listed (in lbs of K_2O/acre) in Table 3.

Table 3: Guidelines for applying potassium to corn in New York State based upon soil test K.

CNAL Soil Test K	Amount of Potassium to Apply (lbs K_2O/acre) Soil Management Group (SMG)				
lbs K/acre	I	II	III	IV	V/VI
≤62	50	60	80	120	120
63-67	50	60	80	115	120
68-72	50	60	80	110	120
73-77	45	55	75	105	120
78-82	40	50	70	100	120
83-87	35	45	65	95	115
88-92	30	40	60	90	110
93-97	25	35	55	85	105
98-102	20	30	50	80	100
103-107	20	25	45	75	95
108-112	20	20	40	70	90
113-117	20	20	35	65	85
118-122	20	20	30	60	80
123-127	20	20	25	55	75
128-132	20	20	20	50	70
133-137	20	20	20	45	65
138-142	20	20	20	40	60
143-147	20	20	20	35	55
148-150	20	20	20	30	50
151-152	0	20	20	30	50
153-157	0	20	20	25	45
158-162	0	20	20	20	40
163-165	0	20	20	20	35
166-167	0	0	20	20	35
168-172	0	0	20	20	30
173-177	0	0	20	20	25
178-195	0	0	20	20	20
196-240	0	0	0	20	20
241-270	0	0	0	0	20
>270	0	0	0	0	0

Sources of Potassium

Potassium chloride, potassium sulfate, and potassium and magnesium sulfates (Table 4) are common K fertilizers containing K that is readily available to plants. The K in manure is soluble and most if not all of it is readily available to plants, so manure K can substitute for fertilizer K on a one-to-one basis.

Table 4: Common fertilizers containing potassium.

Common name	Formula	N	P_2O_5	K_2O	Mg
Muriate of potash	KCl	0	0	60	0
Mono-potassium phosphate	KH_2PO_4	0	~50[1]	40	0
Sulfate of potash	K_2SO_4	0	0	50	0
Sulfate of potash-magnesia	$K_2SO_4MgSO_4$	0	0	22	11

[1] Variable analysis.

Tips for Potassium Management

- Potassium uptake requires an active root system. Drought and management decisions that result in stunted root systems (compaction, shallow seed planting depth) can result in K deficiency symptoms.
- Soil testing can help determine if a K deficiency is likely; however, diseases can stunt root growth and induce K deficiency symptoms independent of soil test K.
- Potassium can accumulate to very high levels in heavily manured corn fields. This K can be used by the next crop in the rotation.
- If K is needed, starter N+K_2O should be limited to no more than 80-100 lbs/acre in the fertilizer band to prevent salt injury. Potassium fertilizer can be broadcast separately as well.

Additional Resources

- Nutrient Management Spear Program Agronomy Fact Sheet Series: http://nmsp.css.cornell.edu
- Nutrient Guidelines for Field Crops in New York: http://nmsp.css.cornell.edu/nutrient_guidelines/
- Cornell Nutrient Analysis Laboratory. http://www.css.cornell.edu/soiltest/newindex.asp.

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For more information

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