POTASSIUM GUIDELINES FOR FIELD CROPS IN NEW YORK

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TABLE OF CONTENTS

1. INTRODUCTION

After nitrogen and phosphorus, potassium (K) is the nutrient most likely to limit plant productivity. It is commonly applied to soils as a fertilizer. Potassium acts as an activator for cellular enzymes involved in processes such as energy metabolism, starch synthesis, nitrate reduction, photosynthesis, nitrogen fixation, and sugar degradation. Potassium plays an important role in lowering cellular osmotic potentials, allowing plants to reduce transpiration from leaves and to increase uptake through the roots. Plants with optimum potassium levels are known to be more resistant to environmental stresses including drought.

Presently, K is not considered a contaminant in water or a threat to water quality. However, K should be managed appropriately to improve crop production economics, reduce its loss, and to prevent excessive build up in soils. Excessive soil K may cause an accumulation of K in the feed ration and pose a health risk for transition cows.

2. POTASSIUM FORMS AND PLANT AVAILABILITY

Soil K can be divided into three major pools of availability. Unavailable or nonexchangeable potassium is contained in soil minerals (micas and feldspars). These primary minerals are the original source of potassium. Plants cannot use K in these crystalline insoluble forms. However, over long periods of time, these soil minerals weather and decompose, thereby releasing K. Most of the soil K is contained in this primary non-exchangeable mineral form.

Readily available K is composed of exchangeable and soil solution K. The total amount of K in this pool is relatively small (one or two percent of the total K in the soil). Potassium is a positively charged ion (cation). It does not leach readily because of its attraction to the soil's negative charge. However, K can leach in very sandy soils with a low cation exchange capacity.

Slowly available or exchangeable K is part of the internal structure of clay minerals of the soil. Some of the readily soluble K applied in fertilizer and manure may be temporarily converted to a more slowly available form within the clay structure.

Much of the K required for crop production can be derived from the pool of exchangeable K. Some potassium may be returned to the soil as a result of leaching from plant foliage by rainwater or irrigation.

3. SOIL MANAGEMENT GROUPS

New York agricultural soils are divided into five mineral soil management groups and a sixth group that includes organic (muck) soils, urban soils, the Adirondack Mountains, Tug Hill, and primarily rock land (Figure 1). There is a good correlation between the groups and their ability to supply K. 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). Table 1 gives an overview of the five mineral soil management groups. A complete list of New York soils and their soil management group classification can be found in Appendix Table C. In the following sections, each of the soil management groups are discussed briefly.

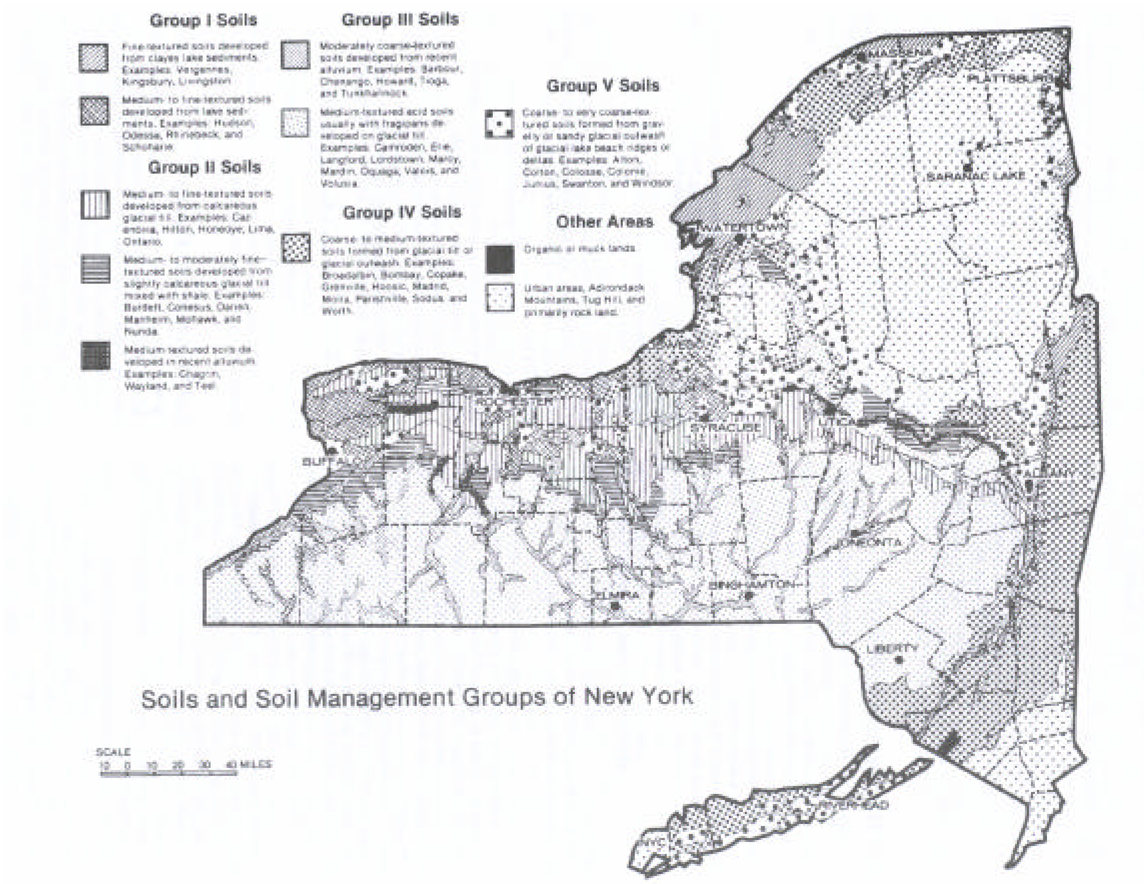

Figure 1: Soils and soil management groups of New York. Printed with permission from the Cornell Field Crops and Soils Handbook (1987). Cornell Cooperative Extension. Ithaca, NY.

Table 1: Soil management groups for New York State agricultural soils (modified from: Cornell Field Crops and Soils Handbook, Cornell Cooperative Extension, 1987).

Soil Management Group	General Description
I	Fine-textured soils developed from clayey lake sediments and medium- to fine-textured soils developed from lake sediments.
II	Medium- to fine-textured soils developed from calcareous glacial till and medium-textured to moderately fine-textured soils developed from slightly calcareous glacial till mixed with shale and medium-textured soils developed in recent alluvium.
III	Moderately coarse-textured soils developed from glacial outwash and recent alluvium and medium-textured acid soils with fragipans developed on glacial till.
IV	Coarse- to medium-textured soils formed from glacial till or glacial outwash.
V	Coarse-textured to very coarse-textured soils formed from gravelly or sandy glacial outwash or glacial lake beach ridges or deltas.
VI	Organic or muck soils with more than 80% organic matter.

3.1 Soil management group I

The soils in this management group are medium- to fine-textured soils developed from lake sediments. They are heavy, generally wet soils formed from lake or marine sediments deposited in glacial lakes. They are characterized by a very slowly permeable subsurface of silty clay to clay.

3.1.1 Subgroup IA

These are fine-textured soils developed from clayey lake sediments. These are the heavy, generally wet soils formed from lake or marine sediments with silty clay loam to clay surfaces over heavier silty clay to clay subsoils. They contain little or no sand or gravel. The slope is generally level or nearly level, and the topography is level to undulating. The very slowly permeable profile and nearly level slopes make soil drainage and water management difficult but very important. Land smoothing and open ditches with good outlets are recommended. Rotations containing sod crops, cultural practices such as fall plowing, the incorporation of organic residues, and timely fitting operations at proper moisture conditions should be used to maintain good soil tilth for optimum crop yields. The water-holding capacity of these soils is high; but because of limited rooting in the clayey subsoils, crops suffer from drought more frequently than when grown on group II or III soils.

The soil pH ranges from 5.4 to 7.0; thus lime may or may not be needed. If the pH is low, large quantities of lime are required. Magnesium on these soils is usually adequate to high. The organic matter content is generally high, but the release of nitrogen (N) is slow, especially in the spring because of the cold, wet nature of these soils. The nitrogen supplying power of these soils usually exceeds 80 pounds per acre per year. The efficiency of applied N is often low, especially if applied pre-plant. These heavy-textured soils are often waterlogged, and some N is lost by denitrification. Side-dressing N increases its efficiency.

Phosphorus (P) is usually low, and the placement of P in the band near the seed at planting is critical. The heavy soil texture and wet, cold spring conditions slow root growth. Thus, the roots cannot extract nutrients from a large volume of soil. This reduces P uptake and increases the probability of a response when placed in the fertilizer band. The K supplying power is high, but restricted root growth decreases the ability of the plant to extract K; therefore, some K containing fertilizers are needed.

The corn yields in this subgroup are generally below 100 bu/acre (17 tons per acre of silage), except for the moderately well drained Vergennes and Wilpoint soils. The yield potential for perennial forages ranges from 2.5 to 4.5 tons/acre (12% moisture). Birdsfoot trefoil and grass are usually the most appropriate species to grow. Examples from group IA clayey soils are the moderately well drained Vergennes, the somewhat poorly drained Kingsbury, and the poorly drained Livingston soils. Large acreages of group IA soils occur in northern New York with limited acres (not shown in Figure 1) in eastern New York and the Hudson Valley.

3.1.2 Subgroup IB

These are medium- to fine-textured soils developed from lake sediments. These soils are formed from glacial lake or marine deposits and have a permeable, very fine sandy loam, silt loam, or silty clay loam surface over a more slowly permeable, heavier silty clay loam to clay subsurface. They differ from subgroup IA because of the more sandy surface and usually a more permeable subsoil. They generally occur on nearly level to gently sloping or rolling landscapes of the lower elevations near the lakes and along the Hudson River. The more rolling landscape makes surface water control and drainage easier than on the nearly level areas, but it increases the erosion hazard. Water and erosion control are important in managing these soils for crop production.

The pH of these soils ranges from 5.2 to 7.4, but most often the pH is 5.8 or above. Most subgroup IB soils need some lime for alfalfa production. The magnesium (Mg) supply is usually adequate.

The organic matter content is generally medium, and the N release is good on the well-drained to moderately well drained soils. The N supplying power generally exceeds 80 lbs per acre per year, but nitrogen loss is a problem as with the subgroup IA soils.

Original P levels are low, but the addition of manure and fertilizer P to cultivated areas may have increased soil P to higher levels. Band placement of P is important for crop establishment where P application is recommended. The K supplying power is high, but continuous cropping without adequate fertilizer can reduce the K levels.

The yield potentials for these soils vary from 75 to 120 bushels of corn per acre (13 to 20 tons of silage) depending on the soil drainage. The potential yields of perennial forage range from 2.5 to 5.5 tons per acre (12% moisture), but only the well-drained and moderately well drained soils are suited for alfalfa production. The Hudson, Odessa, and Schoharie series are examples of the well-drained and moderately well drained soils of the subgroup IB. Other examples are the somewhat poorly and poorly drained Caneadea, Canadice, and Rhinebeck soils and the very poorly drained Lakemont soils.

3.2 *Soil management group II*

The soils of this group are medium-textured to moderately fine-textured soils developed from calcareous glacial till, calcareous glacial till mixed with shale, or recent alluvium. The soils in this management group belong to one of three subgroups depending on parent material. Yield potentials of these soils vary from 75 to 150 bushels of corn (13-26 tons per acre of corn silage) and from 2.5 to 6 tons per acre of forage, depending primarily on the soil drainage characteristics.

3.2.1 Subgroup IIA

Medium- to fine-textured soils developed from calcareous glacial till. These soils are found in areas of undulating to gently rolling topography in the central plains of New York. They are formed from strongly calcareous glacial till. The soil profile is slightly acid to slightly alkaline in the surface and slightly alkaline or strongly alkaline in the subsoil. The surface texture may be a very fine sandy loam, loam, or silt loam with silt loam to silty clay loam subsoils. The water-holding capacity of these soils is high. Lime is usually not required, but surface soil pH's are occasionally low. Additions of manure and fertilizer P have increased the P content to high levels in some soils.

Soil water management is a problem on most of these soils. Erosion control and adequate soil drainage are critical problems. Subsurface drainage is effective in removing excess soil water. Strip-cropping, diversion ditches, sod waterways, and subdrain outlet terraces have successfully provided both erosion control and drainage. Once the water management problems have been solved, these are among the most productive soils of New York State.

Some examples are the well-drained Cazenovia, Hilton, Honeoye, Lima and Ontario series; the somewhat poorly drained Appleton, Kendaia, and Ovid series; and the poorly drained Lyons and Romulus series.

3.2.2 Subgroup IIB

Medium-textured to moderately fine-textured soils developed from slightly calcareous glacial till mixed with shale. These soils generally have a very fine sandy loam or silt loam surface over a heavy silt loam or silty clay loam subsurface. These soils occur on nearly level or slightly undulating to rolling landscapes. They are generally located in the transition zone to the higher lime soils. The sloping landscapes often show signs of erosion, and erosion control practices are generally necessary. On the more level or concave topography and finer-textured soils, drainage is a problem. The better-drained soils of this group are well suited for the production of almost all field crops and vegetables. Almost all soils of this group require lime for legumes, and many must be limed for optimum production of other field crops. In general, the organic matter levels and N supplying power of these soils are medium. The original P supply was low, but P additions have increased it to high levels in some soils. The K supply is high. Some examples are the well-drained to moderately well drained Conesus, Lansing, Mohawk, and Nunda series. The somewhat poorly to poorly drained members include the generally finer textured Burdett, Darien, Kendaia, and Manheim series.

3.2.3 Subgroup IIC

Medium-textured soils developed in recent alluvium. These soils have developed on nearly level, first bottomlands and are subject to spring floods. The better-drained soils are intensively used and highly productive for a wide variety of crops. They have a water-holding capacity of 5 to 9 inches of available water. These are among the most fertile soils in New York. Crops grown on these soils respond to practices that improve soil tilth and minimize soil compaction. Examples are the well-drained Hamlin or Genesee, moderately well drained Teel, and somewhat poorly drained Wayland.

3.3 Soil management group III

The soils in this management group are medium-textured silt loams in both the surface and the subsoil. They are medium in K supplying power. There are two subgroups in this category that are similar in most of their management requirements but can differ in parent material, slope, tillage, and erosion control practices.

3.3.1 Subgroup IIIA

Moderately coarse textured soil developed from recent alluvium. These soils generally have a sandy loam, gravelly loam, or gravelly silt loam surface and gravelly loam, loam, sand or gravel subsurfaces. They occur on gravel outwash plains in the valleys or on glacial kames or eskers. The majority of the soils in this subgroup is level to nearly level and well suited to a variety of crops. Erosion and soil structure are generally not problems. These soils contain about 4 to 7 inches of available water in the soil profile. Irrigation may be required for vegetable production or during dry years for field crops.

The soils located near the high lime glacial tills are usually higher in pH than the soils in the southern part of the state, but lime must be added to most of these soils for optimum crop production. Yield potentials for this group are high with corn yields generally between 110 and 130 bushels per acre on the well-drained and moderately well drained areas. Perennial forage yields range from 2.5 to 5.8 tons per acre (12% moisture) depending on soil drainage. Examples are the well-drained to moderately well drained Barbour, Braceville, Chenango, Howard, Kars, Palmyra, Phelps, and Tioga series. The somewhat poorly drained soils include the Fredon, Holly, and Red Hook series.

3.3.2 Subgroup IIIB

These are medium-textured acid soils with fragipans developed on glacial till. These soils contain shale, sandstone, slate, or schist-type rocks with little or no lime. They have a silt loam surface and a more dense or compacted silt loam subsoil with fragipan or hardpan at various depths below the surface. The depth to the fragipan determines the soil drainage characteristics – the deeper the pan, the better drained the soil. The entire profile contains few to many angular and (or) flat stones of various sizes. The well-drained and moderately well drained soils usually contain 4 to 7 inches of available water; the somewhat poorly drained soils contain 3 to 4 inches. Erosion is a problem on all soils within this group. These sloping soils must be protected to reduce erosion by using combinations of cover crops, strip-cropping, rotations, and diversion ditches.

The pattern of soils within a field is usually complex because of the variable slopes. Most fields will contain two or more soils with different drainage characteristics; that is, the majority of a field may be moderately well drained soil such as Mardin, but in the low places a poorly drained soil such as Chippewa will occur. This type of soil pattern requires diversion terraces to intercept runoff from higher elevations and random subdrainage to eliminate wet spots. Such practices permit more timely and efficient farm operations. Yield potentials for the subgroup IIIB soils are generally lower than for subgroup IIIA because water is often a problem.

The well-drained and moderately well drained soils generally occur on the convex slopes near the top of the hills, on the knolls, or on sloping areas where there is no water seepage. These include the Mardin, Valois, and Langford soils. The well-drained Lordstown and Oquaga soils occur on steeper slopes and are shallow to bedrock. The somewhat poorly and poorly drained soils such a Camroden, Ellery, Erie, Marcy, Morris, and Volusia occur on the longer slopes, and near the bases of hills where water tends to collect or seep from above.

3.4 Soil management group IV

These soils are low in K-supplying power and are coarse- to moderately coarse textured soils formed from glacial till or glacial outwash (Figure 2). There is no subdivision of the soil management IV. The soil texture is sandy loam or silt loam in the surface, with or without gravel. The subsurface ranges from gravelly loam to clay textured. The slopes vary from level to strongly undulating. The somewhat poorly to poorly drained soils of this group can usually be drained effectively with widely spaced tile lines.

Figure 2: Glacial influences set the stage for soil management groups.

These soil profiles usually have an available water capacity of 3 to 5 inches. Crops grown on these soils suffer from insufficient water during extended dry periods, especially if the water table is more than 2 to 3 feet in depth. The soil tilth is excellent, and the soils can be worked over a wide range of moisture conditions without injury. Erosion from wind and water may be a problem in some areas. Most of these soils require regular additions of lime for crop growth. Crops respond well to fertilizers when moisture is adequate. Examples of the well-drained to moderately well drained soils of this group are Bombay, Broadalbin, Copake, Empeyville, Gloucester, Grenville, Hogansburg, Hoosic, Ira, Madrid, Moira, Parishville, Sodus, and Worth. The somewhat poorly to poorly drained soils include Brayton, Fredon, Massena, Scriba, and Westbury.

3.5 Soil management group V

These are coarse- to very coarse-textured soils formed from gravelly or sandy glacial outwash or glacial lake beach ridges or deltas. The parent material for these soils has been reworked by water either as glacial outwash or by wave action from the glacial lakes, removing almost all the fine materials (silt and clay) and leaving usually deep deposits of sand and/or gravel. The soils that form have similar textures, usually with little organic matter. The topography is nearly level to undulating. Most of these soils are excessively drained. The available water capacity is very low, 2 to 3 inches. Supplemental irrigation is essential for consistent crop production. The tilth of these soils is generally good to loose. They can be worked at almost any time following a rain and are commonly used for producing fresh market vegetable crops. They require small, but regular, additions of lime. The fertility needs are great. The soils usually supply less than 50 pounds per acre of available N or K. Leaching of fertilizer N and K is a problem, and additional N and K should be added to the irrigated soils. Without irrigation these soils have low yields, generally less than 90 bushels per acre of corn (15 tons of 35% moisture silage per acre) and 4.5 tons of alfalfa (12% moisture). Examples of the excessively drained to well-drained soils include Alton, Colosse, Colton, Hinckley, and Windsor. The somewhat poorly and poorly drained soils include Claverack, Colonie, Elmwood, Granby, Junius, and Swanton.

3.6 Muck soils

Muck is formed by deposits of decaying organic matter in bogs. Muck lands must be drained before they can be used for agriculture. Water management is extremely important not only for drainage for crop production but also for irrigation and control of the rate of decay of the organic matter. Muck soils are usually high in N, but low in P, K, copper and magnesium. The deep mucks may have marl mixed with, or very close to, the surface. This complicates the fertility program, especially for zinc and manganese.

The muck soils are generally used for the production of vegetable crops, but field crops are sometimes grown. When used for field crops, they should be fertilized with phosphorus and potassium as indicated in the section for soil management group V but N application rates should be reduced one-third to one-half of the rates recommended for mineral soils.

4. SOIL TEST INTERPRETATION AND CONVERSIONS

Cornell University's potassium recommendations are based on decades of yield response trials in New York. The Morgan extraction is the basis for these recommendations. Cornell soil K tests can be interpreted using Table 2.

Table 2: Interpretations of Cornell soil test K data.

Soil Management Group	Soil test K Very Low	Low	Medium	High	Very High
	---------------------Lbs K/acre (CNAL Morgan extraction)--------------------				
I	<35	35-64	65-94	95-149	>149
II	<40	40-69	70-99	100-164	>164
III	<45	45-79	80-119	120-199	>199
IV	<55	55-99	100-149	150-239	>239
V/VI	<60	60-114	115-164	165-269	>269

Mehlich-III soil tests from Brookside Laboratories Inc. (New Knoxville, Ohio), Spectrum Analytic Inc. (Washington C.H., Ohio), and A&L Eastern Laboratories Inc. (Richmond, Virginia), and A&L Canada Laboratories can be used to derive Cornell Morgan equivalents using the following equations. Comparative studies are necessary to derive CNAL Morgan equivalents for Mehlich-III data from other laboratories.

Brookside Laboratories Inc. (n=235, r^2=0.94, range = 42 to 468 ppm K):

CNAL Morgan K (lbs/a) = 2.16 * Brookside M3 K (ppm) - 47 [1]

Spectrum Analytic Inc. (n=235, r^2=0.93, range = 38 to 1094 lbs/acre K):

CNAL Morgan K (lbs/a) = 0.92 * Spectrum M3 K (lbs/acre) – 10 [2]

A&L Eastern Laboratories Inc. (n=232, r^2=0.96, range = 33 to 504 ppm K):

CNAL Morgan K (lbs/a) = 1.77 * A&L E M3 K (ppm) – 15 [3]

A&L Canada Laboratories Inc. (n=228, r^2=0.95, range = 28 to 487 ppm K):

CNAL Morgan K (lbs/a) = 1.99 * A&L C M3 K (ppm) – 18 [4]

If Morgan data from Spectrum Analytic Inc. or modified Morgan data from the University of Vermont are used, the following conversions need to be done:

Spectrum Analytic Inc. (n=82, r^2=0.97, range = 30 to 1250 lbs/acre K):

CNAL Morgan K (lbs/a) = 1.34 * Spectrum Morgan K (lbs/acre) – 29 [5]

University of Vermont (n=232, r^2=0.67, range = 0 to 658 ppm K):

CNAL Morgan K (lbs/a) = 1.20 * UVM Modified Morgan K (ppm) + 31 [6]

5. CALCULATING POTASSIUM RECOMMENDATIONS FOR SPECIFIC FIELD CROPS

Potassium requirements are expressed in lbs of K_2O. The K recommendations for sod crops depend on yield potential, soil test K level and constants associated with the soil type. Because the K supplying potential of the soil groups varies widely, the soil test K interpretation and recommendations vary for each group. Non-sod crop K requirements depend on soil test K level and constants associated with the soil type. Cornell Crop codes can be found in Appendix Table A.

5.1 Corn, millet, sorghum, sorghum sudan hybrid, sudangrass and sunflowers

Potassium requirements for corn (COG, COS), millet (MIL) sorghum forage (SOF), sorghum grain (SOG), sorghum sudan hybrids (SSH), sudangrass (SUD) and sunflowers (SUN) are calculated using the following K requirement equations:

If SoilTestK = 1.5 * A:
K recommendation = 0 lbs K_2O/acre
If SoilTestK = A but < 1.5 * A:
K recommendation = 20 lbs K_2O/acre
If SoilTestK > (Max + 20) but <A:
K recommendation = (20 + A – SoilTestK) K_2O/acre
If SoilTestK = (Max + 20):
K recommendation = (Max) lbs K_2O/acre
[7]

SoilTestK is the Cornell Morgan soil test in lbs K/acre. See Table 3 for the "A" parameter and maximum recommendations.

Table 3: Fitting parameters A and B and minimum and maximum K_2O recommendations for grain corn (COG), corn silage (COS), millet (MIL,) sorghum forage (SOF), sorghum grain (SOG), sorghum sudan hybrids (SSH), sudangrass (SUD) and sunflowers (SUN).

Soil Management Group	Fitting Parameter	Maximum Recommendation (Max)	
	A	(COG, COS)	(MIL, SOF, SOG, SSH, SUD, SUN)
I	100	50	50
II	110	60	60
III	130	80	70
IV	160	120	80
V/VI	180	120	100

This set of equations implies that if the soil test K level is higher than 150% of the "A" value of a specific soil management group, the potassium requirement becomes zero. If the soil test K level between 100 and 150% of the "A" value, the potassium requirement is 20 lbs per acre K_2O. At low soil K levels, a maximum K_2O recommendation rate is set (Table 3). For crop establishment and topdressing potassium, manure can be used to supply the entire requirement. Appendix Table B shows the K recommendations for each of these crops by Cornell Morgan soil test K level. The recommendations in this Table B are rounded to the nearest 5 lbs.

5.2 Soybeans

The K recommendations for soybeans are soil management group and soil test specific as outlined in Table 4.

Table 4: Potassium recommendations (lbs K_2O/acre) for soybeans.

CNAL Morgan extractable K	Soil Management Group		
lbs K/acre	I, II	III	IV, V, VI
<60	40	40	60
60-79	20	40	60
80-99	20	20	60
100-149	20	20	40
150-199	0	20	20
200-269	0	0	20
>269	0	0	0

5.3 Established stands of alfalfa, alfalfa grass, and alfalfa birdsfoot trefoil

The potassium recommendations for established stands of alfalfa (ALT), alfalfa grass (AGT) and alfalfa birdsfoot trefoil (ABT) are derived using the following equations:

Soil management group I:

$$\text{K recommendation (lbs } K_2O\text{/acre)} = [\{(ypa * 40) - SoilTestK\} / 0.6] - 120 \quad [8]$$

Soil management group II:

$$\text{K recommendation (lbs } K_2O\text{/acre)} = [\{(ypa * 40) - SoilTestK\} / 0.6] - 100 \quad [9]$$

Soil management group III:
K recommendation (lbs K_2O/acre) = [{(ypa * 40) – SoilTestK} / 0.6] – 80 [10]

Soil management group IV:
K recommendation (lbs K_2O/acre) = [{(ypa * 40) – SoilTestK} / 0.6] – 60 [11]

Soil management group V and VI:
K recommendation (lbs K_2O/acre) = [{(ypa * 40) – SoilTestK} / 0.6] – 40 [12]

In these equations, ypa is the soil specific alfalfa yield potential in tons/acre (12% moisture) and SoilTestK is the lbs CNAL Morgan extractable K/acre. Soil type specific yield potentials for alfalfa can be found in Appendix Table C.

5.4 Established grasses, intensively managed grass, and native grass pasture

Potassium recommendations for established and intensively managed grass (GIT) and established grasses (GRT) and native grass pasture (PNT) are derived from those for topdressing alfalfa (ALT):

GIT K recommendation (lbs K_2O/acre) = 0.8 * ALT K recommendations
GRT/PNT K recommendation (lbs K_2O/acre) = 0.66 * ALT K recommendations [13]

Derivations for potassium recommendations for established alfalfa were discussed in section 5.3.

5.5 Spring barley, winter barley, oats, and wheat

Potassium requirements for spring barley (BSP), winter barley (BWI), oats (OAT) and wheat (WHT) are calculated using the following general K requirement equation:

If SoilTestK > 165, K_2O recommendation = 0 K_2O/acre
If SoilTestK > 80 but = 165, K_2O recommendation = 20 lbs K_2O/acre
If SoilTestK = 80, K_2O recommendation = (110-STK) * 0.7 lbs K_2O/acre [14]

In this equation, SoilTestK is the amount of CNAL Morgan extractable K in lbs/acre. The recommendations for these crops do not depend on soil management group and become zero for soil with soil test K levels of 166 lbs/acre or higher. Appendix Table D shows the K recommendations (rounded to the nearest 5 lbs of K_2O) for these crops as a function of soil test K level.

5.6 Buckwheat and rye cover crop

Because buckwheat (BUK) is well-adapted to poor soils and easily lodges on highly fertile soils, no K_2O is recommended for soil with soil test K levels of 10 lbs/acre (CNAL Morgan soil test) or higher. The K recommendation for a rye cover crop (RYC) is identical to that of buckwheat. The maximum K recommendation amounts to 50 lbs K_2O/acre on soils with virtually no extractable K. Recommendations decrease with 5 lbs K_2O/acre for each lb/acre increase in soil test K (SoilTestK in lbs K/acre):

$$\text{K recommendation (lbs } K_2O\text{/acre)} = 50 - (5 * \text{SoilTestK}) \quad [15]$$

Appendix Table E shows K recommendations for buckwheat and rye cover crops (rounded to the nearest 5 lbs K_2O) as a function of CNAL Morgan extractable soil test K level.

5.7 Triticale peas

Triticale peas recommendations are soil test but not soil management group specific. Recommendations follow the general equation:

$$\text{K recommendation (lbs } K_2O\text{ /acre)} = (110 - \text{SoilTestK}) * 0.70 \quad [16]$$

In this equation, SoilTestK is the CNAL Morgan test K in lbs/acre. The minimum requirement is 20 lbs K_2O/acre. Appendix Table F lists K_2O recommendations as a function of Cornell Morgan soil test level.

5.8 Established waterways

Established Waterway (WPT) recommendations are dependent on soil test K_2O and the soil management group and use the following equations:

Soil management group I:
$$\text{K recommendation (lbs } K_2O\text{ /acre)} = (100 - \text{SoilTestK}) * 0.88 \quad [17]$$

Soil management group II:
$$\text{K recommendation (lbs } K_2O\text{ /acre)} = (110 - \text{SoilTestK}) * 0.88 \quad [18]$$

Soil management group III:
$$\text{K recommendation (lbs } K_2O\text{ /acre)} = (130 - \text{SoilTestK}) * 1.0 \quad [19]$$

Soil management group IV:
$$\text{K recommendation (lbs } K_2O\text{ /acre)} = (160 - \text{SoilTestK}) * 1.13 \quad [20]$$

Soil management groups V and VI:
$$\text{K recommendation (lbs } K_2O\text{ /acre)} = (200 - \text{SoilTestK})*0.88 \quad [21]$$

5.9 Other crops

Table 5 lists other crops for which K recommendations are available. These crops use the general K recommendation equation: K recommendation (lbs K_2O/acre) = (A-SoilTestK) * B.

Table 5: Crops (with Cornell crop code) that utilize K recommendation equations generated using the general equation: K recommendation = (A-SoilTestK) * B.

Code	Description
ABE	Alfalfa trefoil grass, Establishment
AGE	Alfalfa grass, Establishment
ALE	Alfalfa, Establishment
BCE	Birdsfoot trefoil clover, Establishment
BCT	Birdsfoot trefoil clover, Established
BGE	Birdsfoot trefoil grass, Establishment
BGT	Birdsfoot trefoil grass, Established
BSE	Birdsfoot trefoil seed, Establishment
BST	Birdsfoot trefoil seed, Established
BTE	Birdsfoot trefoil, Establishment
BTT	Birdsfoot trefoil, Established
BSS	Spring barley with legumes
BWS	Winter barley with legumes
CGE	Clover grass, Establishment
CGT	Clover grass, Established
CLE	Clover, Establishment
CLT	Clover, Established

Code	Description
CST	Clover seed production, Established
CVE	Crownvetch, Establishment
CVT	Crownvetch
GIE	Grasses intensively managed, Establishment
GRE	Grasses, Establishment
OAS	Oats with legume
PGE	Pasture improved grasses, Establishment
PGT	Pasture improved grasses, Established
PIE	Pasture intensively grazed, Establishment
PIT	Pasture intensively grazed, Established
PLE	Pasture with legumes, Establishment
PLT	Pasture with legumes, Established
WPE	Waterways, Establishment
WHS	Wheat with legume

Potassium recommendations for these crops are calculated using the following equations:

Soil management group I:
K recommendation (lbs K_2O /acre) = (100 - SoilTestK) * 0.70 [22]

Soil management group II:
K recommendation (lbs K_2O /acre) = (110 - SoilTestK) * 0.70 [23]

Soil management group III:
K recommendation (lbs K_2O /acre) = (130 - SoilTestK) * 0.80 [24]

Soil management group IV:
K recommendation (lbs K_2O /acre) = (160 - SoilTestK) * 0.90 [25]

Soil management groups V and VI:
K recommendation (lbs K_2O /acre) = (200 - SoilTestK) * 0.70 [26]

Appendix Table G shows K recommendations as a function of Cornell Morgan soil test K level for each of the soil management groups. These recommendations are rounded to the nearest 5 lbs K_2O per acre. A minimum application of 20 lbs K_2O is recommended for all crops except for established birdsfoot-trefoil (BTT), birdsfoot-trefoil/clover (BCT), birdsfoot-trefoil/grass (BGT), and birdsfoot-trefoil seed (BST). A maximum application applies for established pasture of improved grasses, and intensively grazed pasture. Maximum application rates for these crops amount to 50, 60, 70, 80 and 100 lbs K_2O/acre for soils in management groups I, II, III, IV, V/VI, respectively. Rye seed production (RYS) recommended K_2O/acre application rate is 10 lbs less than the calculated rate for crops listed in Table 5 (20 lbs per acre minimum application). Potassium addition is not necessary for either establishment or maintenance of Christmas trees.

6. Sources of Potassium and Their Management

Potassium fertilizers (Table 6) contain readily available K. The K in manure is primarily in a soluble form and most if not all of it is readily available to plants. Manure K can be substituted for fertilizer K on a one-to-one basis. Potassium can, and often does, accumulate to very high levels in heavily manured fields. The accumulated K can be used by another crop later in the rotation. Crop monitoring may be important because an excessive amount of K in the feed ration can affect animal health for transition cows.

Potassium fertilizers are primarily mined from deposits of potassium chloride, potassium sulfate, and potassium and magnesium sulfates. Applications of fertilizer K are important on fields where soil test K levels are low to medium, especially when manure will not be applied. Always check the fertilizer label for its guaranteed composition (there may be slight deviation from the values listed in Table 6).

For crop establishment, if the fertilizer recommendation is less than 20 lbs K_2O per acre, the entire amount should be applied as fertilizer. For larger applications, apply 20 lbs of K_2O fertilizer and use the K_2O equivalents in manure to supply the rest. To prevent salt injury, $N+K_2O$ applications should be limited to no more than 80-100 lbs in the fertilizer band at planting. Potassium fertilizer can be broadcast and incorporated separately. If more than 80 lbs of $N+K_2O$ needs to be applied, it is recommended to reduce the band rate to contain no more than 80 lbs and to apply the remaining as a pre-plant or side-dress application.

Table 6: Common potassium containing fertilizers

Common name	Chemical formula	N	P_2O_5	K_2O	Mg
Muriate of potash	KCl	0	0	60	0
Monopotassium 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.

BACKGROUND LITERATURE

The following references summarize the corn and alfalfa research that contributed to the development of the current fertilizer recommendations for New York field crops:

- Klausner S.D. and E.A. Goyette. 1993. Soil fertility research: 1992. Department of Soil, Crop and Atmospheric Sciences Research Series R93-2. Cornell University, Ithaca NY.
- Klausner S.D. and E.A. Goyette. 1992. Soil fertility research: Corn 1991. Department of Soil, Crop and Atmospheric Sciences Research Series R92-1. Cornell University, Ithaca NY.
- Klausner S.D. and E.A. Goyette. 1992. Soil fertility research: Alfalfa 1991. Department of Soil, Crop and Atmospheric Sciences Research Series R92-2. Cornell University, Ithaca NY.
- Klausner S.D., W.S. Reid and E.A. Goyette. 1991. Soil fertility research: Corn 1990. Department of Soil, Crop and Atmospheric Sciences Research Series R91-1. Cornell University, Ithaca NY.
- Klausner S.D., W.S. Reid and E.A. Goyette. 1991. Soil fertility research: Alfalfa 1990. Department of Soil, Crop and Atmospheric Sciences Research Series R91-2. Cornell University, Ithaca NY.
- Klausner, S.D., and W.S. Reid, 1990. Soil fertility research for corn, 1989. Agronomy Mimeo 90-1. Cornell University, Ithaca NY.
- Klausner, S.D., and W.S. Reid, 1990. Soil fertility research for alfalfa, 1989. Agronomy Mimeo 90-2. Cornell University, Ithaca NY.
- Klausner, S.D., W.S. Reid, G. Ferguson, and E.A. Goyette, 1989. Calibrating a fertilizer and plant analysis program for corn. 1988 Agronomy Mimeo 89-3. Agronomy Department, Cornell University, Ithaca NY.

APPENDIX TABLE A: CORNELL CROP CODES.

Crop Code	Crop Description
	Alfalfa
ABE	Alfalfa trefoil grass, Establishment
ABT	Alfalfa trefoil grass, Established
AGE	Alfalfa grass, Establishment
AGT	Alfalfa grass, Established
ALE	Alfalfa, Establishment
ALT	Alfalfa, Established
	Birdsfoot
BCE	Birdsfoot trefoil clover, Establishment
BCT	Birdsfoot trefoil clover, Established
BGE	Birdsfoot trefoil grass, Establishment
BGT	Birdsfoot trefoil grass, Established
BSE	Birdsfoot trefoil seed, Establishment
BST	Birdsfoot trefoil seed, Established
BTE	Birdsfoot trefoil, Establishment
BTT	Birdsfoot trefoil, Established
	Barley
BSP	Spring barley
BSS	Spring barley with legumes
BUK	Buckwheat
BWI	Winter barley
BWS	Winter barley with legumes
	Clover
CGE	Clover grass, Establishment
CGT	Clover grass, Established
CLE	Clover, Establishment
CLT	Clover, Established
CSE	Clover seed production, Establishment
CST	Clover seed production, Established
	Corn
COG	Corn grain
COS	Corn silage

APPENDIX TABLE A (CONTINUED)

Crop Code	Crop Description
	Grasses, pastures, covercrops
CVE	Crownvetch, Establishment
CVT	Crownvetch
GIE	Grasses intensively managed, Establishment
GIT	Grasses intensively managed, Established
GRE	Grasses, Establishment
GRT	Grasses, Established
PGE	Pasture, Establishment
PGT	Pasture improved grasses, Established
PIE	Pasture intensively grazed, Establishment
PIT	Pasture intensively grazed, Established
PLE	Pasture with legumes, Establishment
PLT	Pasture with legumes, Established
PNT	Pasture native grasses
RYC	Rye cover crop
RYS	Rye seed production
TRP	Triticale peas
	Small grains
MIL	Millet
OAS	Oats with legume
OAT	Oats
SOF	Sorghum forage
SOG	Sorghum grain
SOY	Soybeans
SSH	Sorghum sudangrass hybrid
SUD	Sudangrass
WHS	Wheat with legume
WHT	Wheat
	Others
SUN	Sunflower
TRE	Christmas trees, Establishment
TRT	Christmas trees, Established

APPENDIX B: POTASSIUM RECOMMENDATIONS FOR CORN SILAGE (COS), GRAIN CORN (COG), MILLET (MIL) SORGHUM FORAGE (SOF), SORGHUM GRAIN (SOG), SORGHUM SUDAN HYBRIDS (SSH), SUDANGRASS (SUD) AND SUNFLOWERS (SUN).

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

APPENDIX TABLE C: SOIL MANAGEMENT GROUP (SMG) AND ALFALFA YIELD POTENTIAL (YP IN TONS/ACRE 12% MOISTURE) FOR UNDRAINED (UD) AND ARTIFICIALLY DRAINED (DR) NEW YORK SOILS.

Soil Name	SMG	ALF YP UD (ton/a)	ALF YP DR (ton/a)
Acton	4	4.0	5.5
Adams	5	4.5	4.5
Adirondack	4	4.0	4.0
Adjidaumo	1	2.5	3.5
Adrian	6	2.5	4.0
Agawam	4	6.0	6.0
Albia	3	3.5	4.5
Albrights	2	4.5	5.0
Alden	3	2.0	3.5
Allagash	5	5.0	5.0
Allard	3	6.0	6.0
Allendale	3	2.5	3.5
Allis	3	2.5	4.5
Alluvial Land	3	3.0	4.0
Almond	3	2.5	3.0
Alps	3	4.5	5.0
Altmar	5	4.5	5.0
Alton	5	5.5	5.5
Amboy	4	5.5	5.5
Amenia	4	5.0	5.5
Angola	2	3.0	4.5
Appleton	2	4.0	4.5
Arkport	4	5.5	5.5
Armagh	2	2.5	4.0
Arnot	3	4.0	4.0
Ashville	3	3.0	3.5
Atherton	3	2.5	4.0
Atkins	3	2.0	3.5
Atsion	5	3.0	4.5
Au Gres	5	3.0	4.5
Aurelie	3	2.0	2.5
Aurora	2	4.5	4.5
Barbour	3	6.0	6.0
Barcelona	3	3.5	4.5

Soil Name	SMG	ALF YP UD (ton/a)	ALF YP DR (ton/a)
Barre	1	2.5	4.0
Bash	3	5.0	5.5
Basher	3	5.5	6.0
Bath	3	5.0	5.0
Becket	4	4.5	4.5
Becraft	3	5.5	6.0
Belgrade	3	5.5	6.0
Benson	4	4.0	4.0
Berkshire	5	5.5	5.5
Bernardston	4	5.5	5.5
Berrien	5	4.5	5.0
Berryland	5	2.0	3.5
Beseman	6	2.5	3.5
Bice	5	5.0	5.0
Biddeford	2	2.0	3.5
Birdsall	3	2.5	3.5
Blasdell	3	5.5	5.5
Bombay	4	5.0	5.5
Bonaparte	4	4.5	4.5
Bono	1	3.0	4.0
Boots	6	2.5	3.5
Borosaprists	6	2.0	3.5
Boynton	3	2.5	4.0
Braceville	4	4.0	5.0
Brayton	4	3.0	4.5
Bridgehampton	3	6.0	6.0
Bridport	2	3.5	4.5
Briggs	4	5.0	5.0
Brinkerton	2	2.5	4.0
Broadalbin	4	5.5	5.5
Brockport	1	4.0	4.5
Brookfield	3	5.0	5.0
Buckland	3	0.0	4.0
Bucksport	6	2.0	3.5

APPENDIX TABLE C (CONTINUED)

Soil Name	SMG	ALF YP UD (ton/a)	ALF YP DR (ton/a)
Budd	4	5.5	5.5
Burdett	2	4.0	4.5
Burnham	3	2.0	3.5
Busti	3	3.5	4.0
Buxton	2	5.0	5.5
Cambria	2	2.5	3.5
Cambridge	3	5.0	5.5
Camillus	3	5.0	5.0
Camroden	3	4.0	4.5
Canaan	4	4.5	4.5
Canaan-Rock Outcrop	4	4.5	4.5
Canadice	2	3.0	4.0
Canandaigua	3	2.5	4.0
Canaseraga	3	5.0	5.5
Canastota	2	4.5	5.0
Caneadea	2	4.0	4.5
Canfield	3	4.5	5.0
Canton	4	5.5	5.5
Carbondale	6	2.0	3.5
Carlisle	6	2.0	3.5
Carrollton	3	3.5	3.5
Carver	5	4.0	4.0
Carver-Plymouth	5	4.0	4.0
Castile	4	5.5	5.5
Cathro	6	2.5	3.5
Cathro-Greenwood	6	2.5	3.5
Cattaraugus	3	5.5	5.5
Cavode	2	3.5	4.5
Cayuga	2	5.5	5.5
Cazenovia	2	5.5	5.5
Ceresco	3	6.0	6.0
Chadakoin	3	5.5	5.5
Chagrin	3	6.0	6.0
Champlain	5	3.5	3.5
Charles	3	2.0	3.0

Soil Name	SMG	ALF YP UD (ton/a)	ALF YP DR (ton/a)
Charlton	4	5.5	5.5
Chatfield	4	4.5	4.5
Chatfield	4	4.5	4.5
Chaumont	1	3.0	4.0
Chautauqua	3	5.0	5.0
Cheektowaga	5	3.0	4.0
Chenango	3	5.5	5.5
Cheshire	4	5.0	5.0
Chippeny	6	2.0	3.5
Chippewa	3	2.5	4.0
Churchville	2	3.0	4.5
Cicero	2	3.5	4.5
Clarkson	2	5.5	6.0
Claverack	4	5.5	5.5
Clymer	4	5.0	5.0
Cohoctah	4	2.5	3.5
Collamer	3	5.5	6.0
Colonie	5	4.5	4.5
Colosse	4	4.5	4.5
Colrain	4	5.5	5.5
Colton	5	4.5	4.5
Colwood	3	2.5	4.0
Conesus	2	5.0	5.5
Conotton	3	5.5	5.5
Constable	5	4.5	4.5
Cook	5	2.5	3.5
Copake	4	6.0	6.0
Cornish	3	3.5	4.5
Cosad	4	4.0	5.0
Cossayuna	4	5.5	5.5
Covert	4	5.0	5.5
Coveytown	4	3.0	4.5
Covington	1	2.5	3.5
Crary	4	4.0	4.5
Croghan	5	4.5	4.5
Culvers	3	4.5	5.0
Dalbo	3	4.5	4.5
Dalton	3	3.0	4.0

APPENDIX TABLE C (CONTINUED)

Soil Name	SMG	ALF YP UD (ton/a)	ALF YP DR (ton/a)
Danley	2	4.5	5.0
Dannemora	4	2.5	3.5
Darien	2	3.5	4.5
Dawson	6	2.5	3.5
Deerfield	5	4.5	4.5
Deford	4	4.0	4.0
Dekalb	4	5.0	5.0
Depeyster	3	5.5	6.0
Deposit	3	5.0	5.5
Derb	3	3.5	4.0
Dixmont	5	4.5	5.0
Dorval	6	2.0	3.5
Dover	4	5.5	5.5
Duane	4	4.0	4.5
Dunkirk	3	5.5	5.5
Dutchess	4	5.5	5.5
Duxbury	4	5.0	5.0
Edwards	6	2.5	3.5
Eel	2	4.5	5.5
Eelweir	4	5.0	5.5
Elka	4	4.5	4.5
Ellery	3	2.5	4.0
Elmridge	5	4.5	5.5
Elmwood	4	4.5	5.0
Elnora	5	4.5	5.0
Empeyville	4	3.5	4.5
Enfield	3	5.5	5.5
Ensley	3	3.0	3.5
Erie	3	3.0	4.0
Ernest	3	4.0	4.0
Essex	5	4.5	4.5
Fahey	5	4.0	4.5
Farmington	3	4.0	4.0
Farnham	4	5.0	5.5
Fernlake	4	3.0	3.0
Fonda	2	2.0	3.5
Fredon	4	3.0	4.0
Freetown	6	2.5	3.5
Fremont	2	3.0	4.5
Frenchtown	3	2.5	4.0
Frewsburg	3	3.0	4.0
Fryeburg	3	4.0	4.0
Gage	3	3.0	4.0
Galen	4	5.0	5.5
Galestown	5	4.0	4.0
Galoo	4	3.5	3.5
Galoo-Rock Outcrop	4	3.5	3.5
Galway	4	5.0	5.0
Genesee	2	6.5	6.5
Georgia	4	5.0	5.5
Getzville	3	3.0	3.5
Gilpen	3	4.0	4.0
Gilpin	3	4.0	4.0
Glebe	4	3.0	3.0
Glebe-Saddleback	4	3.0	3.0
Glendora	4	3.0	3.0
Glenfield	3	2.5	3.5
Gloucester	4	4.5	4.5
Glover	4	3.5	3.5
Gougeville	5	2.0	4.0
Granby	5	2.0	3.5
Grattan	5	4.5	4.5
Greene	3	3.0	4.0
Greenwood	6	2.0	3.0
Grenville	4	5.5	5.5
Gretor	3	2.5	3.0
Groton	4	4.5	5.0
Groveton	4	4.0	5.0
Guff	1	2.5	3.0
Guffin	1	2.5	3.5
Gulf	4	2.5	3.5
Hadley	3	5.0	5.0
Haights	3	3.0	3.5
Haights-Gulf	3	3.0	3.5

APPENDIX TABLE C (CONTINUED)

Soil Name	SMG	ALF YP UD (ton/a)	ALF YP DR (ton/a)
Hailesboro	3	4.0	5.0
Halcott	2	3.0	3.5
Halsey	4	2.5	3.5
Hamlin	2	6.5	6.5
Hamplain	2	5.5	5.5
Hannawa	4	3.0	4.0
Hartland	4	6.0	6.0
Haven	4	6.0	6.0
Hawksnest	3	2.5	3.0
Hempstead	4	6.0	6.0
Henrietta	6	2.0	3.5
Herkimer	3	5.5	6.0
Hermon	4	5.0	5.0
Hero	4	5.5	6.0
Heuvelton	2	4.5	5.5
Hilton	2	5.5	6.0
Hinckley	5	4.5	4.5
Hinesburg	4	5.5	5.5
Hogansburg	4	5.0	5.5
Hogback	5	4.0	4.0
Hogback-Ricker	5	4.0	4.0
Holderton	3	4.0	4.5
Hollis	4	3.5	4.5
Holly	2	2.5	3.5
Holyoke	3	4.0	4.0
Holyoke-Rock Outcrop	3	4.0	4.0
Homer	2	4.0	5.0
Honeoye	2	5.5	5.5
Hoosic	4	5.0	5.0
Hornell	2	3.0	4.0
Hornellsville	3	2.5	3.0
Houghtonville	5	4.5	4.5
Houghtonville-Rawson	5	4.5	4.5
Housatonic	3	3.0	4.5
Houseville	2	4.0	5.0
Howard	3	5.5	5.5
Hudson	2	5.0	5.5
Hulberton	2	4.0	4.5
Ilion	2	2.5	4.0
Insula	4	3.0	3.0
Ipswich	6	2.5	3.5
Ira	4	4.5	5.0
Ischua	3	4.0	4.5
Ivory	2	2.5	3.0
Jebavy	5	3.0	4.0
Joliet	4	2.5	4.0
Junius	5	3.0	4.0
Kalurah	4	5.0	5.5
Kanona	2	2.5	3.5
Kars	4	5.5	5.5
Kearsarge	3	3.0	3.0
Kendaia	2	4.0	4.5
Kibbie	3	4.0	5.0
Kingsbury	1	3.5	4.5
Kinzua	3	4.5	4.5
Knickerbocker	5	4.5	4.5
Lackawanna	3	5.5	5.5
Lagross	3	5.0	5.0
Lagross-Haights	3	5.0	5.0
Lairdsville	2	4.5	4.5
Lakemont	1	2.5	3.5
Lakewood	5	4.0	4.0
Lamson	4	2.5	4.0
Lanesboro	3	4.0	4.0
Langford	3	4.5	5.0
Lansing	2	5.5	5.5
Leck Kill	3	4.0	4.0
Leicester	4	2.5	3.5
Leon	5	3.0	4.5
Lewbath	3	4.5	4.5
Lewbeach	3	5.5	5.5
Leyden	2	4.5	5.0

APPENDIX TABLE C (CONTINUED)

Soil Name	SMG	ALF YP UD (ton/a)	ALF YP DR (ton/a)
Lima	2	5.0	5.5
Limerick	3	3.0	4.5
Linden	4	6.0	6.0
Linlithgo	3	3.5	4.5
Livingston	1	2.0	3.0
Lobdell	3	4.5	5.5
Lockport	2	4.0	4.5
Lordstown	3	4.5	4.5
Lovewell	2	4.5	5.5
Lowville	4	5.0	5.0
Loxley	6	2.5	3.5
Lucas	2	5.0	5.5
Ludlow	4	5.0	5.5
Lupton	6	2.5	3.5
Lyman	4	4.0	4.0
Lyman-Becket-Berkshi	4	4.0	4.0
Lyme	5	2.5	4.0
Lyons	2	2.5	3.5
Machias	4	4.5	5.0
Macomber	4	3.5	3.5
Macomber-Taconic	4	3.5	3.5
Madalin	1	2.5	3.5
Madawaska	5	4.5	5.0
Madrid	4	5.5	5.5
Malone	4	3.5	4.5
Manahawkin	6	2.5	3.5
Mandy	3	4.0	4.0
Manheim	2	3.5	4.5
Manhoning	2	3.0	4.5
Manlius	3	4.5	4.5
Mansfield	3	2.0	3.5
Maplecrest	2	5.5	5.5
Marcy	3	3.0	4.0
Mardin	3	4.5	5.0
Marilla	3	4.0	4.5
Markey	6	2.0	3.5
Marlow	4	5.0	5.0
Martisco	6	2.5	3.5
Massena	4	3.5	4.5
Matoon	1	3.0	4.0
Matunuck	6	2.5	3.0
Medihemists	6	2.0	3.5
Medomak	3	2.0	2.5
Melrose	4	5.0	5.0
Menlo	4	2.5	3.5
Mentor	4	5.5	5.5
Merrimac	4	5.0	5.0
Middlebrook	3	4.0	4.5
Middlebrook-Mongaup	3	4.0	4.5
Middlebury	3	4.5	5.5
Millis	4	5.0	5.0
Millsite	4	4.5	4.5
Mineola	4	5.0	5.5
Miner	1	2.5	3.5
Mino	4	3.0	5.0
Minoa	4	3.0	5.0
Mohawk	2	5.5	5.5
Moira	4	4.0	5.0
Monadnock	4	3.5	3.5
Monarda	4	3.5	4.5
Mongaup	3	4.5	4.5
Montauk	4	5.0	5.0
Mooers	5	3.0	3.5
Morocco	4	3.0	4.0
Morris	3	3.5	4.5
Mosherville	4	3.5	4.5
Muck	6	2.0	3.5
Muck-Peat	6	2.0	3.5
Mundal	4	3.5	3.5
Mundalite	3	4.5	4.5
Mundalite-Rawsonvill	3	4.5	4.5
Munson	2	3.5	4.5

APPENDIX TABLE C (CONTINUED)

Soil Name	SMG	ALF YP UD (ton/a)	ALF YP DR (ton/a)
Munuscong	4	2.0	3.5
Muskego	6	2.0	3.5
Muskellunge	3	3.5	4.5
Napoleon	6	2.0	3.5
Napoli	3	2.5	3.5
Nassau	4	4.0	4.0
Naumburg	5	3.0	4.5
Nehasne	4	5.0	5.0
Nellis	4	5.5	5.5
Neversink	4	2.0	3.5
Newfane	4	5.5	5.5
Newstead	4	3.5	4.5
Newton	5	2.0	3.5
Niagara	3	4.0	5.0
Nicholville	4	4.0	4.5
Ninigret	4	5.5	6.0
Norchip	3	2.5	3.5
Norwell	5	3.5	4.5
Norwich	3	2.5	3.5
Nunda	2	5.0	5.5
Oakville	5	4.5	4.5
Occum	4	5.5	5.5
Odessa	2	4.0	4.5
Ogdensburg	4	3.5	4.5
Olean	2	5.5	6.0
Ondawa	4	6.0	6.0
Oneida	4	3.5	4.5
Onoville	3	4.0	4.5
Ontario	2	6.0	6.0
Onteora	3	3.5	4.5
Ontusia	3	3.5	4.5
Oquaga	3	4.5	4.5
Oramel	2	5.5	5.5
Organic	6	2.5	3.5
Orpark	2	3.5	4.5
Orwell	2	3.0	4.5
Ossipee	6	2.0	3.5
Otego	2	5.0	5.5

Soil Name	SMG	ALF YP UD (ton/a)	ALF YP DR (ton/a)
Otisville	4	4.5	4.5
Otsego	3	4.5	5.0
Ottawa	5	5.0	5.0
Ovid	2	4.0	4.5
Palatine	2	4.5	4.5
Palms	6	2.5	3.5
Palmyra	3	5.5	5.5
Panton	1	3.5	4.5
Papakating	2	2.5	3.5
Parishville	4	4.0	5.0
Parsippany	1	2.5	3.5
Patchin	3	2.5	3.5
Pawcatuck	6	2.5	3.5
Pawling	4	5.5	5.5
Paxton	4	5.0	5.0
Peacham	3	2.0	3.0
Peat	6	2.5	3.5
Peat-Muck	6	2.0	3.5
Peru	4	4.5	5.0
Petoskey	4	5.5	5.5
Phelps	3	5.0	5.5
Philo	3	5.5	6.0
Pillsbury	4	2.5	4.0
Pinckney	3	4.5	4.5
Pipestone	5	2.5	4.0
Pittsfield	4	5.5	5.5
Pittstown	4	5.0	5.5
Plainbo	5	3.0	3.0
Plainfield	5	4.5	4.5
Plessis	3	3.5	4.0
Plymouth	4	4.0	4.0
Podunk	4	5.5	6.0
Poland	2	5.5	5.5
Pompton	4	4.5	5.0
Pootatuck	4	5.0	5.5
Pope	4	5.5	5.5
Potsdam	4	5.0	5.0
Poygan	1	2.0	3.0

APPENDIX TABLE C (CONTINUED)

Soil Name	SMG	ALF YP UD (ton/a)	ALF YP DR (ton/a)
Punsit	3	3.0	4.5
Pyrities	4	5.5	5.5
Quetico	4	3.0	3.0
Quetico-Rock Outcrop	4	3.0	3.0
Raquette	4	4.0	5.0
Rawsonville	5	4.0	4.0
Rawsonville-Beseman-	5	4.0	4.0
Rayne	3	5.0	5.0
Raynham	3	3.5	4.5
Raypol	3	2.5	3.5
Red Hook	4	3.5	4.5
Redwater	3	4.5	5.5
Remsen	2	3.0	4.5
Retsof	2	3.5	4.5
Rexford	4	3.0	4.5
Rhinebeck	2	4.0	4.5
Ricker	4	4.0	4.0
Ricker-Lyman	4	4.0	4.0
Ridgebury	4	3.0	4.0
Rifle	6	2.5	3.5
Riga	2	4.5	4.5
Rippowam	4	2.5	3.5
Riverhead	4	4.5	5.5
Rockaway	2	5.5	5.5
Romulus	2	3.0	4.0
Ross	2	6.0	6.0
Roundabout	3	3.5	4.0
Rumney	2	2.0	4.0
Runeberg	4	2.0	3.0
Ruse	4	2.5	3.5
Rushford	3	4.5	5.0
Saco	3	2.0	3.0
Salamanca	3	4.0	4.5
Salmon	4	5.0	5.0
Saprists	6	2.0	3.5
Saugatuck	5	3.0	4.5

Soil Name	SMG	ALF YP UD (ton/a)	ALF YP DR (ton/a)
Scantic	2	3.0	4.5
Scarboro	4	2.5	4.0
Schoharie	1	5.0	5.0
Schroon	5	5.0	5.0
Schuyler	3	4.5	5.0
Scio	3	5.0	5.5
Scituate	4	4.5	4.5
Scriba	4	3.5	4.5
Searsport	4	2.5	4.0
Shaker	2	3.5	4.5
Shoreham	2	2.0	3.5
Sisk	4	2.0	3.5
Skerry	5	4.0	4.5
Sloan	3	2.0	3.5
Sodus	4	5.0	5.0
Somerset	5	3.0	4.5
St Johns	4	2.5	4.0
Staatsburg	3	4.0	4.0
Stafford	4	3.5	4.5
Steamburg	3	4.0	4.5
Stetson	5	5.0	5.0
Stissing	4	2.5	4.0
Stockbridge	3	5.5	5.5
Stockholm	5	3.0	4.0
Stowe	4	4.5	4.5
Sudbury	4	4.0	5.0
Suffield	2	5.0	5.5
Summerville	4	4.0	4.0
Sun	4	2.5	3.5
Sunapee	4	3.5	4.5
Suncook	5	3.0	3.0
Suny	4	2.0	3.4
Surplus	4	2.0	3.5
Surplus-Sisk	4	2.0	3.5
Sutton	4	5.0	5.0
Swanton	4	3.0	4.5
Swartswood	4	5.0	5.0
Swormville	1	3.0	4.5

APPENDIX TABLE C (CONTINUED)

Soil Name	SMG	ALF YP UD (ton/a)	ALF YP DR (ton/a)
Taconic	3	3.5	3.5
Taconic-Macomber	3	3.5	3.5
Tawas	6	2.5	3.5
Teel	2	4.5	5.5
Toledo	2	2.0	3.5
Tonawanda	2	3.0	4.5
Tor	4	2.0	3.5
Torull	3	3.0	4.0
Towerville	3	4.5	5.0
Trestle	3	5.5	5.5
Trout River	5	4.0	4.0
Troy	3	5.0	5.5
Trumbull	1	2.5	3.5
Tughill	4	2.5	3.5
Tuller	3	3.5	4.0
Tunbridge	4	4.5	4.5
Tunbridge-Adirondack	4	4.5	4.5
Tunkhannock	3	5.5	5.5
Turin	2	3.0	4.5
Tuscarora	4	5.5	5.5
Unadilla	3	6.0	6.0
Valois	3	5.5	5.5
Varick	2	2.5	3.5
Varysburg	2	5.5	5.5
Venango	3	3.5	4.5
Vergennes	1	4.5	5.0
Vly	3	4.0	4.0
Volusia	3	3.5	4.5
Waddington	4	5.0	5.0
Wainola	5	3.0	4.5
Wakeland	3	3.5	4.5
Wakeville	3	4.0	5.0
Wallace	5	4.0	4.0
Wallington	3	3.5	4.5
Wallkill	3	2.0	4.0
Walpole	4	3.0	4.5

Soil Name	SMG	ALF YP UD (ton/a)	ALF YP DR (ton/a)
Walton	3	5.5	5.5
Wampsville	3	5.5	5.5
Wappinger	3	6.0	6.0
Wareham	5	3.0	4.5
Warners	3	2.0	3.5
Wassaic	4	4.5	4.5
Watchaug	4	3.0	4.0
Waumbeck	4	3.0	4.5
Wayland	2	2.5	3.5
Weaver	3	3.5	4.5
Wegatchie	3	2.5	4.0
Wellsboro	3	4.5	5.0
Wenonah	4	5.0	5.0
Westbury	4	3.0	4.5
Westland	2	2.5	3.5
Wethersfield	4	5.5	5.5
Wharton	2	4.5	5.0
Whately	4	2.0	3.5
Whippany	2	3.5	4.5
Whitelaw	4	5.5	5.5
Whitman	4	2.0	3.5
Wilbraham	4	3.0	4.5
Willdin	3	4.5	5.0
Willette	6	2.5	3.5
Williamson	4	4.5	5.0
Willowemoc	3	4.5	5.0
Wilmington	4	2.5	4.0
Wilpoint	1	4.0	5.0
Windsor	5	4.5	4.5
Winooski	4	5.0	5.0
Wolcottsburg	1	2.5	3.5
Wonsqueak	6	2.0	3.5
Woodbridge	4	4.5	5.0
Woodlawn	4	4.5	4.5
Woodstock	4	4.0	4.0
Woodstock-Rock Outcrop	4	4.0	4.0
Wooster	3	5.0	5.0

APPENDIX TABLE C (CONTINUED)

Soil Name	SMG	ALF YP UD (ton/a)	ALF YP DR (ton/a)
Woostern	3	5.5	5.5
Woostern-Bath-Valois	3	5.5	5.5
Worden	4	2.0	3.5
Worth	4	4.5	4.5
Wurtsboro	4	4.0	4.5
Wyalusing	3	3.0	4.0
Yalesville	4	5.0	5.0
Yorkshire	3	3.5	4.0

APPENDIX TABLE D: POTASSIUM RECOMMENDATIONS FOR SPRING BARLEY (BSP), WINTER BARLEY (BWI), OATS (OAT) AND WHEAT (WHT).

CNAL Morgan Soil Test lbs K/acre	K recommendation lbs K_2O/acre
≤6	75
7-13	70
14-20	65
21-27	60
28-35	55
36-42	50
43-49	45
50-56	40
57-63	35
64-70	30
71-77	25
78-165	20

APPENDIX TABLE E: POTASSIUM RECOMMENDATIONS FOR BUCKWHEAT (BUK) AND RYE COVER CROP (RYC).

CNAL Morgan Soil Test lbs K/acre	K recommendation lbs K_2O/acre
<1	50
1	45
2	40
3	35
4	30
5	25
6	20
7	15
8	10
9	5
≥10	0

APPENDIX TABLE F: POTASSIUM RECOMMENDATIONS FOR TRITICALE PEAS (TRP).

CNAL Morgan Soil Test lbs K/acre	K recommendation lbs K_2O/acre
≤6	75
7-13	70
14-20	65
21-27	60
28-35	55
36-42	50
43-49	45
50-56	40
57-63	35
64-70	30
71-77	25
>77	20

APPENDIX TABLE G: POTASSIUM RECOMMENDATION FOR ALFALFA (ABE, AGE, ALE), BIRDSFOOT TREFOIL (BCE, BCT, BGE, BGT, BSE, BSS, BST, BTE, BTT, BWS), CLOVER (CGE, CGT, CLE, CLT), PASTURE (PGT, PIT), AND RYE SEED (RYS)[1]. See Appendix Table A for a description of crop codes.

CNAL Morgan Soil test K	K recommendation				
	Soil Management Group				
	I	II	III	IV	V/VI
lbs K/acre	------------------------------------lbs K_2O/acre------------------------------------				
≤1	70	75	105	145	140
2-3	70	75	100	140	140
4-6	65	75	100	140	135
7	65	70	100	140	135
8	65	70	100	135	135
9-10	65	70	95	135	135
11-12	60	70	95	135	130
13	60	70	95	130	130
14	60	65	95	130	130
15-17	60	65	90	130	130
18	55	65	90	130	125
19-20	55	65	90	125	125
21-23	55	60	85	125	125
24-25	55	60	85	120	125
26	50	60	85	120	120
27	50	60	80	120	120
28-29	50	55	80	120	120
30-32	50	55	80	115	120
33	45	55	80	115	115
34-35	45	55	75	115	115
36-39	45	50	75	110	115
40	40	50	70	110	110
41-42	40	50	70	105	110
43-45	40	45	70	105	110
46	40	45	65	105	110
47-49	35	45	65	100	105
50-51	35	40	65	100	105
52-53	35	40	60	95	105

[1] Minimum recommendations are 20 lbs K_2O/acre for the above-mentioned crops except BCT, BGT, BST and BTT. Maximum recommendations for PGT, PIT and RYS are 50, 60, 70, 80 and 100 lbs K_2O/acre for SMG I, II, III, IV, and V/VI, respectively.

APPENDIX TABLE G (CONTINUED)

CNAL Morgan Soil test K	K recommendation				
	Soil Management Group				
	I	II	III	IV	V/VI
lbs K/acre	------------------------------------lbs K_2O/acre------------------------------------				
54-56	30	40	60	95	100
57	30	35	60	95	100
58	30	35	60	90	100
59-60	30	35	55	90	100
61-62	25	35	55	90	95
63	25	35	55	85	95
64	25	30	55	85	95
65-67	25	30	50	85	95
68	20	30	50	85	90
69-70	20	30	50	80	90
71-73	20	25	45	80	90
74-75	20	25	45	75	90
76	15	25	45	75	85
77	15	25	40	75	85
78-79	15	20	40	75	85
80-82	15	20	40	70	85
83	10	20	40	70	80
84-85	10	20	35	70	80
86-89	10	15	35	65	80
90	5	15	30	65	75
91-92	5	15	30	60	75
93-95	5	10	30	60	75
96	5	10	25	60	75
97	0	10	25	60	70
98-99	0	10	25	55	70
100-101	0	5	25	55	70
102-103	0	5	20	50	70
104-106	0	5	20	50	65
107	0	0	20	50	65
108	0	0	20	45	65
109-110	0	0	15	45	65
111-112	0	0	15	45	60
113-114	0	0	15	40	60
115-118	0	0	10	40	60
119-120	0	0	10	35	60
121-123	0	0	5	35	55
124-125	0	0	5	30	55

APPENDIX TABLE G (CONTINUED)

CNAL Morgan Soil test K	K recommendation				
	Soil Management Group				
	I	II	III	IV	V/VI
lbs K/acre	--------------------------------lbs K_2O/acre--------------------------------				
126	0	0	5	30	50
127-129	0	0	0	30	50
130-132	0	0	0	25	50
133-135	0	0	0	25	45
136-139	0	0	0	20	45
140	0	0	0	20	40
141-143	0	0	0	15	40
144-146	0	0	0	15	40
147-151	0	0	0	10	35
152-153	0	0	0	5	35
154-157	0	0	0	5	30
158-160	0	0	0	0	30
161-167	0	0	0	0	25
168-175	0	0	0	0	20
176-182	0	0	0	0	15
183-189	0	0	0	0	10
190-196	0	0	0	0	5
>196	0	0	0	0	0

Ketterings, Q.M., S.D. Klausner and K.J. Czymmek (2003). Potassium recommendations for field crops in New York. Second Release. Department of Crop and Soil Extension Series E03-14. Cornell University, Ithaca NY. 41 pages.