POTASSIUM GUIDELINES FOR FIELD CROPS IN NEW YORK

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Executive Summary

- Potassium (K) is an essential macronutrient, taken up by crops in large quantities. Potassium is not an element of concern for environmental, off-farm impacts. However, its deficiency can impact both crop yield and quality while excess K can result in luxury consumption and hence high K forages.

- This manual presents Land Grant University guidelines for K management of field crops. It replaces Ketterings et al. (2003). Crops include, among others, corn grown for grain, corn grown for silage, grass hay, mixed grass and alfalfa stands, sorghum-sudan hybrids, forage sorghum, teff, and winter cereals grown for forage production in corn and sorghum rotations.

- Non-sod crop K guidelines depend on soil test K level and constants associated with the soil type. The K guidelines for sod crops depend on realistic yields (yield index or YI), Cornell Morgan soil test K (STK) results and constants associated with the soil type. Because the K supplying potential of the soil groups varies widely, the STK interpretation and guidelines vary for each group. If field-specific yield data are available, it is recommended to use those data rather than the YI values listed for sod crops in this document.

- If K is needed for optimal crop growth and production, it can be supplied as fertilizer or as manure. The K in manure is primarily in a soluble form and most if not all of it is readily available to plants.

Acknowledgments

Agronomic potassium fertilizer guidelines for many field crops in New York were first developed based on decades of field research by emeriti professors D.R. Bouldin, S.D. Klausner, D.J. Lathwell, and W.S. Reid. An earlier version of this document was co-authored in 2003 by S.D. Klausner and K.J. Czymmek, then Senior Extension Associate in nutrient management with the PRO-DAIRY program.

Over the past 20 years, additional research has focused on including more crops, new rotations, and reviewing and updating of guidelines and book values for yield indices. This 2024 edition of the Potassium Fertility Guidelines for Field Crops in New York includes a new classification for soil test interpretations and updated alfalfa yield database. Soil management group information listed in section 3 is from the Cornell Field Crops and Soils Handbook (1987). The soil series figures (Figures 2-7) were generated by E. Buell, NMSP intern in the summer in 2014. The potassium supplying power of soils in NY map (Figure 1b) was generated by S.D. DeGloria and M. Roberts in 2010.

We thank K.J. Czymmek with whom many of the previous guidelines were co-developed. We also thank G. Albrecht, B. Jordan, R. Bush (New York State Department of Agriculture and Markets, NYSAGM), J. Hornesky (Natural Resources Conservation Service, NRCS), and S. Latessa (New York State Department of Environmental Conservation, NYSDEC), for reviewing this document. We are grateful to the many New York Agricultural Environmental Management (AEM) Certified Planners, Certified Crop Advisers (CCAs), Cornell Cooperative Extension (CCE) staff, Soil and Water Conservation District staff (SWCD), Natural Resources Conservation Service (NRCS) staff, and farmers who participated in on-farm research trials, gave valuable feedback as guidance systems were being developed and serve on the Cornell NMSP Advisory Committees.

Acronyms

- AEM: Agricultural Environmental Management
- CCA: Certified Crop Adviser
- CCE: Cornell Cooperative Extension
- NMSP: Nutrient Management Spear Program
- NRCS: Natural Resources Conservation Service
- NYSAGM: New York State Department of Agriculture and Markets
- NYSDEC: New York State Department of Environmental Conservation
- SMG: Soil management group
- STK: soil test K level measured by the Cornell Morgan extraction method
- SWCD: Soil and Water Conservation District
- YI: Yield Index

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1. Introduction

Potassium (K) is an essential macronutrient that is taken up in large quantities by many of the field crops grown in New York. 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 K levels are known to be more resistant to environmental stresses including drought.

Potassium is not considered a contaminant in water nor 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 as excess K will result in luxury consumption (plants taking up more K than they need; see Cherney et al., 2004; Ketterings et al., 2011). In general, high K forages fed in an un-balanced diet to transition cows around calving time may lead to metabolic or other health concerns. Cornell guidelines for K management of field crops uses crop codes for each crop (see Appendix A for the full list of crop codes).

2. Potassium Forms and Plant Availability

Soil K can be divided into three major pools of availability: (1) unavailable K, (2) readily available K, and (3) slowly available K. Unavailable or non-exchangeable K is contained in soil minerals (micas and feldspars). These primary minerals are the original source of K. Most of the soil K is contained in this primary non-exchangeable mineral form. Plants cannot use K in these crystalline insoluble forms. However, soil minerals weather and decompose over time, thereby releasing K. 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). Slowly available K is part of the internal structure of clay minerals of the soil. Some of the readily soluble K in fertilizer and manure may be temporarily converted to slowly available K within the clay structure. Much of the K required for crop production can be derived from the pool of slowly available K. Some K may be returned to the soil because of leaching from plant foliage by rainwater or irrigation. As soils differ in their K supplying capacity, for many field crops Cornell K guidelines take into account the soil type in addition to soil test K results.

3. Soil Management Groups

New York agricultural soils are divided into five mineral soil management groups (SMGs) and a sixth group that includes organic (muck) soils, urban soils, the Adirondack Mountains, Tug Hill, and primarily rock land (Figure 1A). 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). A complete list of New York soils and their SMG classification can be found in Appendix B. In the following sections, each of the SMGs are discussed briefly.

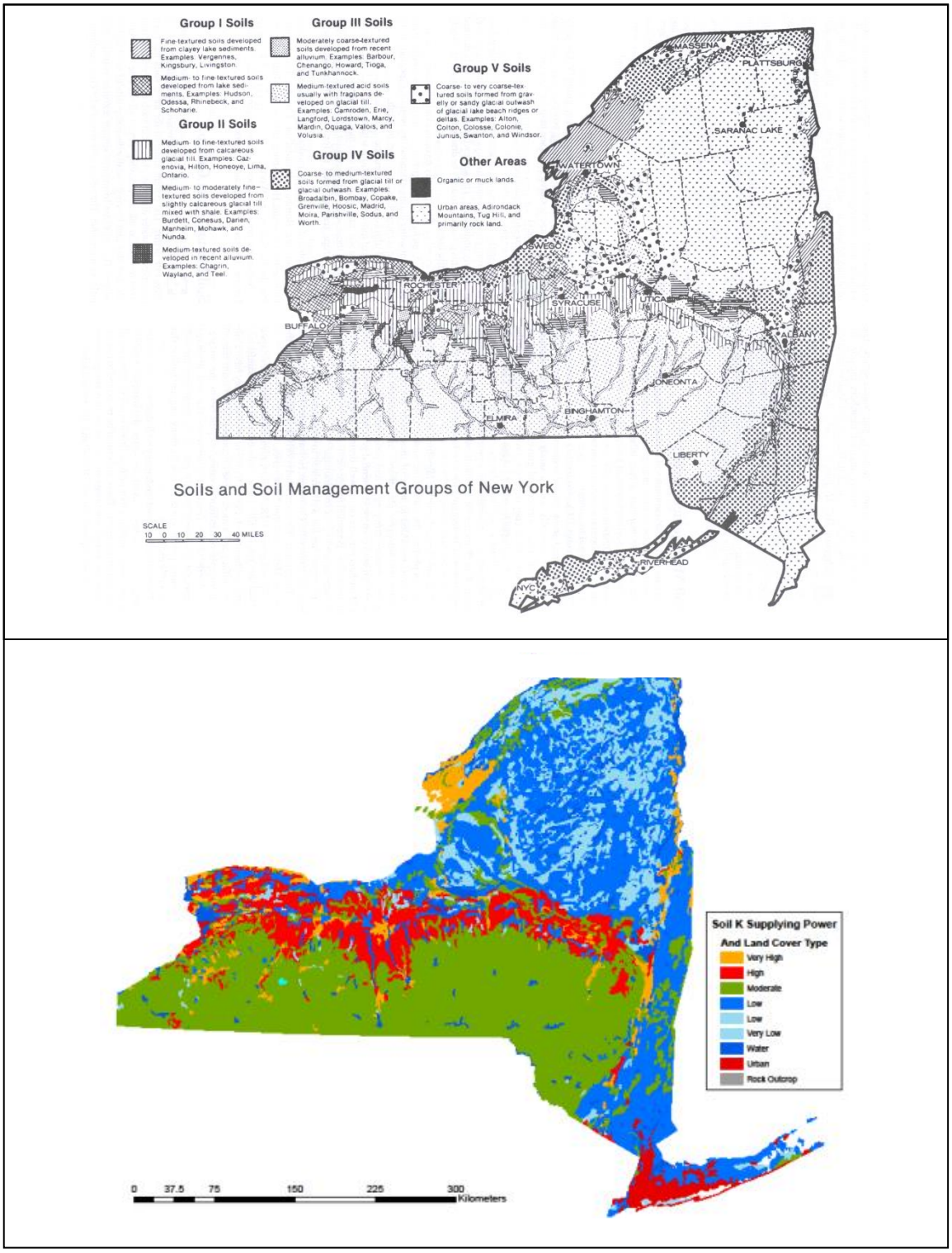

Figure 1: Soil management groups (A), and soil potassium supplying power (B) of New York soils. Printed with permission from the Cornell Field Crops and Soils Handbook (Bergstrom et al., 1987) (1A). The K supplying power map is courtesy of S.D. DeGloria and M. Roberts (2010).

Table 1: Soil management groups (SMGs) for New York State agricultural soils (modified from the Cornell Field Crops and Soils Handbook; Bergstrom et al., 1987).

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 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.
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 glacial 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.

3.1 SOIL MANAGEMENT GROUP 1

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 have a very slowly permeable silty clay to clay subsurface.

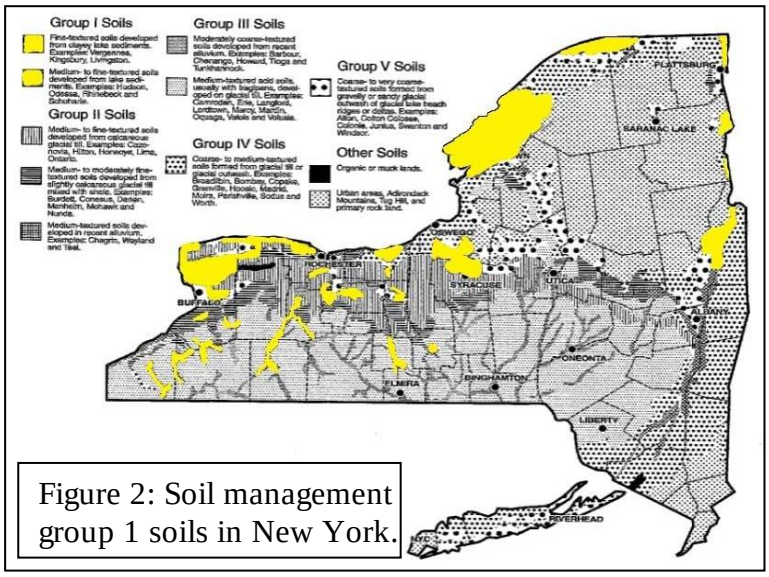

Figure 2: Soil management group 1 soils in New York.

Subgroup IA

These are fine-textured soils developed from clayey lake sediments. These are the heavy, generally wet soils 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. These soils are high in K supplying power and the water-holding capacity of these soils is high. However, because of limited rooting in the clayey subsoils, crops suffer from drought more frequently than when grown on group 2 or 3 soils and drought can result in limited K uptake by the plants. Examples are the moderately well drained Vergennes, the somewhat poorly drained Kingsbury, and the poorly drained Livingston soils.

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 sandier 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. They are high in K supplying power. Hudson, Odessa, and Schoharie are examples of the well-drained and moderately well drained soils of the subgroup 1B. Caneadea, Canadice, and Rhinebeck are examples of somewhat poorly and poorly drained soils. Lakemont soils are very poorly drained.

3.2 SOIL MANAGEMENT GROUP 2

Soils in this SMG are medium-textured to moderately fine-textured soils developed from calcareous glacial till, calcareous glacial till mixed with shale, or recent alluvium. There are three subgroups depending on parent material.

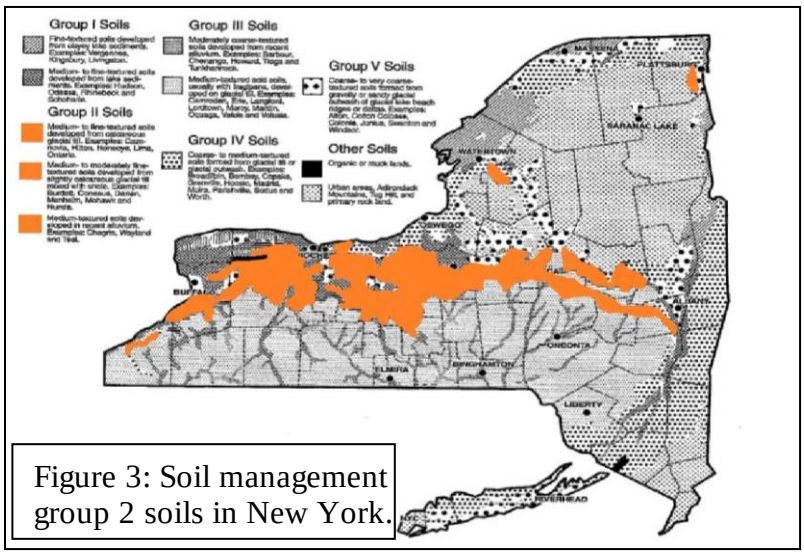

Figure 3: Soil management group 2 soils in New York.

Subgroup 2A

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. 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. They are high in K supplying power. Some examples are the well-drained Cazenovia, Hilton, Honeoye, Lima and Ontario; the somewhat poorly drained Appleton, Kendaia, and Ovid; and the poorly drained Lyons and Romulus.

Subgroup 2B

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 to produce almost all field crops and vegetables. They are high in K supplying power. 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.

Subgroup 2C

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. They are high in K-supplying power. Examples are the well-drained Hamlin or Genesee, moderately well drained Teel, and somewhat poorly drained Wayland.

3.3 SOIL MANAGEMENT GROUP 3

The soils in this SMG 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.

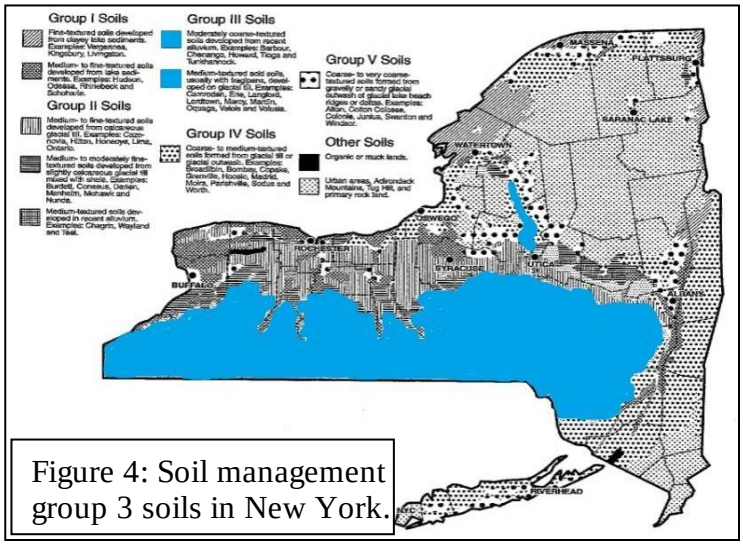

Figure 4: Soil management group 3 soils in New York.

Subgroup 3A

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. Most of the soils in this subgroup are 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. These soils are medium in K supplying power. 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.

Subgroup 3B

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, crop rotations, and diversion ditches. 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 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 4

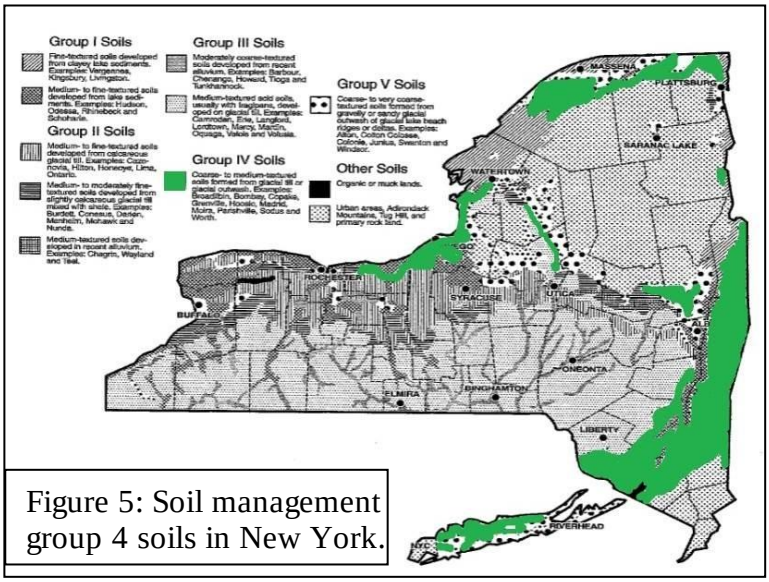

Figure 5: Soil management group 4 soils in New York.

These soils are low in K-supplying power and are coarse- to moderately coarse textured soils formed from glacial till or glacial outwash. There is no subdivision. 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. 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 5

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. 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. The K supplying power of these soils is low. 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.

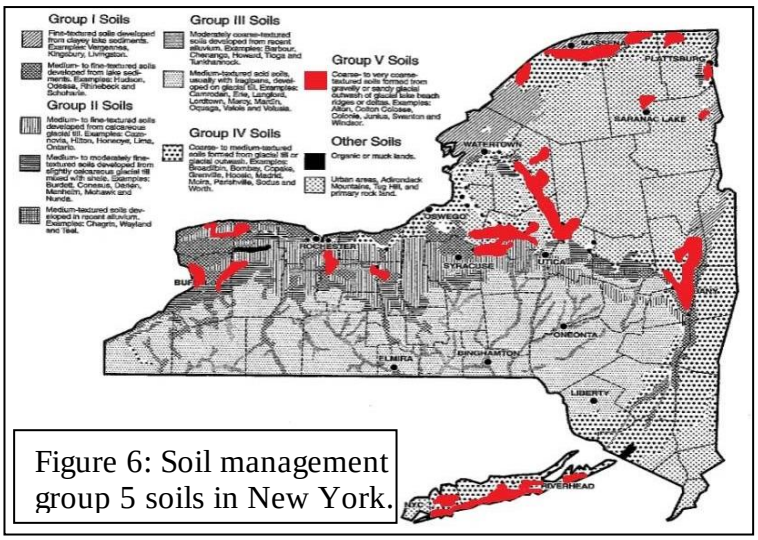

Figure 6: Soil management group 5 soils in New York.

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. The deep mucks may have marl mixed with, or very close to, the surface. Muck soils in agricultural production are typically used for vegetables, but field crops are sometimes grown as well. These soils are low in K supplying capacity.

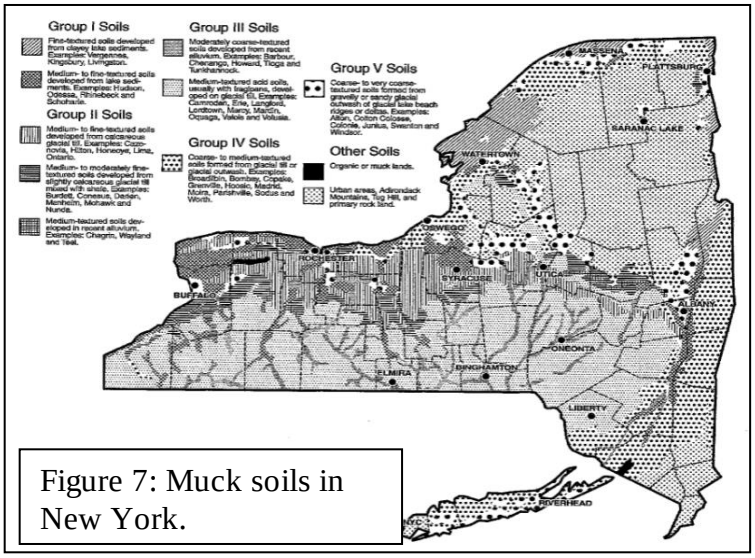

Figure 7: Muck soils in New York.

4. Soil Test Interpretation and Conversions

The Cornell Morgan extraction is the basis for Cornell guidelines. Given the differences in soil K supply potential across New York soils (section 3), the interpretations of a Cornell soil test K (STK) result depend not only on the soil test results but also on the soil type of the field. Once the soil type is known, the SMG of the soil type can be derived (Appendix B). With both STK and SMG information, the interpretations of the STK results can be derived using Table 2. As an example, a field with a Kingsbury soil (SMG 1) and a soil test result of 97 lbs Morgan K/acre is classified as optimum in K, while with the same soil test results a field with a Hogansburg soil (SMG 4) is classified as low in K.

Table 2: Interpretations of Cornell soil test K data for soils of soil managements groups (SMGs) 1 through 6. See Appendix B to determine the SMG for a specific soil type.

SMG	Soil test K				
	Very Low	Low	Medium	Optimum	Very High
	---------- lbs K/acre (Cornell 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

Cornell University fertilizer guidelines are based on decades of field research in New York showing soil nutrients extracted by Morgan solution (sodium acetate buffered at pH 4.8) using 0-8 inch soil samples are correlated well with nutrient response for the vast array of soil types in New York. Conversion equations are needed to convert from Mehlich-3 analyses (unbuffered solution of acetate, ammonium nitrate, ammonium fluoride, and ethylenediaminetetraacetic acid) to a Cornell Morgan equivalent. Mehlich-3 soil tests from Brookside Laboratories Inc. (New Bremen, Ohio), Spectrum Analytic Inc. (Washington Court House, Ohio), A&L Canada Laboratories (London, Ontario), and DairyOne (Ithaca, New York) can be used to derive Cornell Morgan K equivalents using the following equations. Comparative studies are necessary to derive CNAL Morgan equivalents for Mehlich-3 data from other laboratories.

Brookside Laboratories Inc. (n=235, r^2=0.94, range = 42 to 468 ppm K):
Cornell Morgan K (lbs/acre) = 2.16 * Brookside M3 K (ppm) – 47 [1]

Spectrum Analytic Inc. (n=235, r^2=0.93, range = 38 to 1094 lbs/acre K):
Cornell Morgan K (lbs/acre) = 2.19 * Spectrum M3 K (lbs/acre) – 10 [2]

A&L Canada Laboratories Inc. (n=228, r^2=0.95, range = 28 to 487 ppm K):
Cornell Morgan K (lbs/acre) = 1.99 * A&L C M3 K (ppm) – 18 [3]

DairyOne (n=223, r^2=0.96, range = 22 to 532 ppm K)
Cornell Morgan K (lbs/acre) = 1.77 * DairyOne M3 K (ppm) – 1 [4]

5. Potassium Guidelines for Specific Field Crops

Potassium guidelines are expressed in lbs of K_2O and will need to be converted to lbs of material by considering the percentage of K_2O in a specific fertilizer or manure source. See section 6 for more information on K fertilizers. The K guidelines for sod crops depend on yield index values, STK, and constants associated with the soil type. Because the K supplying potential of soils in New York varies widely (see section 3), STK interpretation and guidelines for sod crops are SMG specific. Less information is available on the interactions of soil type, soil test K and plant K needs for non-sod crops and for those crops, K guidelines are derived using STK and constants associated with the crop.

5.1 CORN, MILLET, SORGHUM, SORGHUM-SUDAN, SUDANGRASS, SUNFLOWER

Potassium guidelines 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 STK $\geq$ 1.5 * A:	K recommendation = 0 lbs K_2O/acre
If STK $\geq$ A but < 1.5 * A:	K recommendation = 20 lbs K_2O/acre
If STK > (Max + 20) but <A:	K recommendation = (20 + A – STK) K_2O/acre
If STK $\leq$ (Max + 20):	K recommendation = (Max) lbs K_2O/acre [5]

In these equations STK is the Cornell Morgan soil test in lbs K/acre. See Table 3 for the "A" parameter and maximum recommendations. This set of equations implies that if the STK is higher than 150% of the "A" value of a specific soil management group, no additional K is recommended. If the STK is between 100 and 150% of the "A" value, the K guideline is 20 lbs per acre K_2O. At low STK, a maximum K_2O recommendation rate is set (Table 3). Guidelines are rounded to the nearest 5 lbs. Appendix C shows the K guidelines for each of these crops by Cornell Morgan STK. For crop establishment and topdressing K, manure can be used to supply the entire requirement.

Table 3: Fitting parameter A and maximum K guidelines for grain corn (COG), corn silage (COS), millet (MIL) sorghum forage (SOF), sorghum grain (SOG), sorghum-sudan hybrids (SSH), sudangrass (SUD), and sunflowers (SUN).

SMG	Fitting parameter	Maximum (Max; lbs K_2O/acre)	
	A	(COG, COS)	(MIL, SOF, SOG, SSH, SUD, SUN)
1	100	50	50
2	110	60	60
3	130	80	70
4	160	120	80
5/6	180	120	100

5.2 SOYBEANS

The K guidelines for soybeans are SMG and STK specific as outlined in Table 4.

Table 4: Potassium guidelines (lbs K_2O/acre) for soybeans derived from soil test K (STK, Cornell Morgan in lbs K/acre) and soil management group (SMG).

Soil test K (STK)	Soil Management Group (SMG)		
lbs K/acre	1,2	3	4,5,6
<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 ALFALFA, ALFALFA GRASS, ALFALFA BIRDSFOOT TREFOIL

The K guidelines for established alfalfa (ALT), alfalfa grass (AGT) and alfalfa birdsfoot trefoil (ABT) are derived using the following equations:

SMG 1:

K recommendation (lbs K_2O/acre) = [{(YI_a * 40) – STK} / 0.6] – 120 [6]

SMG 2:

K recommendation (lbs K_2O/acre) = [{(YI_a * 40) – STK} / 0.6] – 100 [7]

SMG 3:

K recommendation (lbs K_2O/acre) = [{(YI_a * 40) – STK} / 0.6] – 80 [8]

SMG 4:

K recommendation (lbs K_2O/acre) = [{(YI_a * 40) – STK} / 0.6] – 60 [9]

SMG 5 and 6:

K recommendation (lbs K_2O/acre) = [{(YI_a * 40) – STK} / 0.6] – 40 [10]

In these equations, YI_a is the soil specific alfalfa yield potential in tons/acre (12% moisture) and STK is the Morgan soil test result in lbs K/acre. For soil type specific yield indices for alfalfa, with and without implementation of artificial drainage, see Appendix B.

For farms with yield data, average yield for a specific field can substitute for the YI_a values from Appendix B. If only three years of reliable yield data exist, it is recommended to drop the lowest yielding year from the average while yield tracking continues. With four years of data, drop the lowest yielding year from the average to obtain a 3-year average while tracking continues. With five years of data, up to two low yielding years could be dropped to determine a realistic 3-year average. Once five years of data are obtained, maintain a rolling average of the most recent five years with the option to drop the two lowest yielding years from the average. Alfalfa yield is entered in tons/acre at 12% moisture. Appendix D shows the K guidelines by Cornell Morgan STK. For crop establishment and topdressing K, manure can be used to supply the entire requirement.

5.4 Established grass and native grass pasture

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

GRT/PNT K recommendation (lbs K_2O/acre) = 0.66 * ALT K recommendations

GIT K recommendation (lbs K_2O/acre) = 0.8 * ALT K recommendations [11]

Derivations for K guidelines for established alfalfa are described in section 5.3.

5.5 Spring barley, winter barley, oats, wheat

Potassium guidelines for spring barley (BSP), winter barley (BWI), oats (OAT) and wheat (WHT) are calculated using the following equations:

If STK > 165, K_2O recommendation = 0 K_2O/acre

If STK > 80 but ≤ 165, K_2O recommendation = 20 lbs K_2O/acre

If STK ≤ 80, K_2O recommendation = (110-STK) * 0.7 lbs K_2O/acre [12]

In this equation, STK is Morgan extractable K in lbs/acre. The guidelines for these crops do not depend on SMG and become zero for soil with STK of 166 lbs/acre or higher. Appendix E shows the K guidelines (rounded to the nearest 5 lbs of K_2O) for these crops as a function of the soil's Cornell Morgan STK.

5.6 Buckwheat and rye cover crop

Guidelines for buckwheat (BUK) and rye cover crop (RYC) depend on the STK of a field, but not its SMG. Because buckwheat (BUK) is well-adapted to poor soils and easily lodges on highly fertile soils, no K_2O is recommended for soil with STK levels of 10 lbs Morgan K/acre or higher. The maximum amount of K recommended is 50 lbs K_2O/acre on soils with virtually no extractable K. The K guidelines for a rye cover crop (RYC) and BUK are identical:

K recommendation (lbs K_2O/acre) = 50 – (5 * STK) [13]

Appendix F shows K guidelines for both crops (rounded to the nearest 5 lbs K_2O) as a function of the Cornell Morgan extractable STK for the field.

5.7 Triticale peas

Triticale peas (TRP) K guidelines are STK but not SMG specific and there is a minimum requirement of 20 lbs K_2O/acre:

K recommendation (lbs K_2O /acre) = (110 – STK) * 0.70 [14]

In this equation, STK is the Cornell Morgan STK in lbs/acre. Appendix G lists K_2O guidelines for triticale peas as a function of STK.

5.8 ESTABLISHED WATERWAYS

The K guidelines for established waterway (WPT) are dependent on STK and SMG:

SMG 1: K recommendation (lbs K_2O /acre) = (100 - STK) * 0.88 [15]

SMG 2: K recommendation (lbs K_2O /acre) = (110 - STK) * 0.88 [16]

SMG 3: K recommendation (lbs K_2O /acre) = (130 - STK) * 1.00 [17]

SMG 4: K recommendation (lbs K_2O /acre) = (160 - STK) * 1.13 [18]

SMG 5/6: K recommendation (lbs K_2O /acre) = (200 - STK) * 0.88 [19]

5.9 OTHER CROPS

Table 5 lists other crops for which K guidelines were developed. These crops use the approach where K recommendation (lbs K_2O/acre) = (A - STK) * B.

Table 5: Crops (with Cornell crop code) with potassium (K) guidelines that follow the general equation: K recommendation = (A - STK) * B.

Code	Crop description	Code	Crop description
ABE	Alfalfa trefoil grass, establishment	CLT	Clover, established
AGE	Alfalfa grass, establishment	CST	Clover seed production, established
ALE	Alfalfa, establishment	CVE	Crownvetch, establishment
BCE	Birdsfoot trefoil/clover, establishme	CVT	Crownvetch, established
BCT	Birdsfoot trefoil/clover, established	GIE	Grass intensely managed, establishme
BGE	Birdsfoot trefoil/grass, establishment	GRE	Grass, establishment
BGT	Birdsfoot trefoil/grass, established	OAS	Oats with legume
BSE	Birdsfoot trefoil seed, establishment	PGE	Pasture improved grass, establishment
BST	Birdsfoot trefoil seed, established	PGT	Pasture improved grass, established
BTE	Birdsfoot trefoil, establishment	PIE	Pasture intensively grazed, establishment
BTT	Birdsfoot trefoil, established	PIT	Pasture intensively grazed, established
BSS	Spring barley with legumes	PLE	Pasture with legumes, establishment
BWS	Winter barley with legumes	PLT	Pasture with legumes, established
CGE	Clover grass, establishment	WPE	Waterways, establishment
CGT	Clover grass, established	WHS	Wheat with legume
CLE	Clover, establishment		

For the crops in table 5, K guidelines are calculated per SMG using the following equations:

SMG 1: K recommendation (lbs K_2O/acre) = (100 - STK) * 0.70 [20]

SMG 2: K recommendation (lbs K_2O/acre) = (110 - STK) * 0.70 [21]

SMG 3: K recommendation (lbs K_2O/acre) = (130 - STK) * 0.80 [22]

SMG 4: K recommendation (lbs K_2O/acre) = (160 - STK) * 0.90 [23]

SMG 5/6: K recommendation (lbs K_2O/acre) = (200 - STK) * 0.70 [24]

A minimum application of 20 lbs K_2O is recommended for all the crops in this section 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 (PGT) and intensively grazed pasture (PIT). Maximum application rates for these crops amount to 50, 60, 70, 80 and 100 lbs K_2O/acre for soils in management groups 1, 2, 3, 4, 5/6, respectively. The recommended K application rate for rye seed production (RYS) is 10 lbs less than the calculated rate for crops listed in Table 5 (with a 20 lbs/acre minimum application). Potassium addition is not necessary for either establishment or maintenance of Christmas trees.

6. Sources of Potassium and 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. Thus, manure K can be substituted for fertilizer K on a one-to-one basis. Potassium can, and often does, accumulate to levels above the optimum range in heavily manured fields. The accumulated K can be used by another crop later in the rotation. However, crop monitoring for K content may be important because an excessive amount of K in feed rations 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 STK is low to medium, especially when manure will not be applied. Always check the fertilizer label for its guaranteed composition as 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, it is recommended to apply the entire amount 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, reduce the band rate to contain no more than 80 lbs and 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[1]	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.

References

Cited references:

- Bergstrom, W.G., Cox, W.J., Ferguson, G.A., Klausner, S.D., Pardee, W.D., Reid, W.S., Seaney, R.R., Shields, E.J., Waldron, J.K. (1987). Cornell Field Crops and Soils Handbook. Accesible at: https://hdl.handle.net/1813/4041.
- Cherney, J.H., Q.M. Ketterings, and J.L. Orloski (2004). Plant and soil elemental status as influenced by multi-year nitrogen and potassium fertilization. Journal of Plant Nutrition 27: 991-1014. https://doi.org/10.1081/PLN-120037532
- Ketterings, Q.M., G. Godwin, J. Cherney, and K. Czymmek (2011). Effect of manure, compost, and potassium application on alfalfa yield, potassium content and soil test potassium in Aurora, NY. What's Cropping Up? 21(4): 8-12. https://projects.sare.org/wp-content/uploads/1546wcu-potassium-yield.pdf

Relevant Cornell Agronomy Fact Sheets:

- Agronomy Fact Sheet 1: Soil Sampling for Field Crops
  http://nmsp.cals.cornell.edu/publications/factsheets/factsheet1.pdf
- Agronomy Fact Sheet # 19: Soil Management Groups
  http://nmsp.cals.cornell.edu/publications/factsheets/factsheet19.pdf
- Agronomy Fact Sheet # 40: Potassium for Corn
  http://nmsp.cals.cornell.edu/publications/factsheets/factsheet40.pdf
- Agronomy Fact Sheet # 61: Valuing Manure N, P, and K Applications
  http://nmsp.cals.cornell.edu/publications/factsheets/factsheet61.pdf

Appendix A: Cornell crop codes

Crop category	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 trefoil	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
Grass/pasture/cover crop	CVE	Crownvetch, Establishment
	CVT	Crownvetch, Established
	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

Crop category	Crop code	Crop description
Small grains	MIL	Millet
	OAS	Oats with legume
	OAT	Oats
	SOF	Sorghum forage
	SOG	Sorghum grain
	SOY	Soybeans
	SSH	Sorghum-sudan hybrid
	SUD	Sudangrass
	WHS	Wheat with legume
	WHT	Wheat
Others	SUN	Sunflower
	TRE	Christmas trees, Establishment
	TRT	Christmas trees, Established

Appendix B: Soil management group and alfalfa yield index for undrained and artificially drained New York soils. See section 5.3 for equations to derive potassium guidelines for alfalfa (crop codes: ALT, AGT, ABT).

Soil management group (SMG; 1 through 6), drainage class (D; V=very poorly drained; P=poorly drained; S=somewhat poorly drained; M=moderately drained; W=well-drained) and alfalfa yield indices for artificially drained (DR) and undrained (UD) fields.				
Name	SMG	D	YI_alfalfa (YI_a)	
			DR	UD
Acton	4	M	5.5	4.0
Adams	5	W	4.5	4.5
Adirondack	4	W	4.0	4.0
Adjidaumo	1	P	3.5	2.5
Adrian	6	V	4.0	2.5
Agawam	4	W	6.0	6.0
Albia	3	S	4.5	3.5
Albrights	2	M	5.0	4.5
Alden	3	V	3.5	2.0
Allagash	5	W	5.0	5.0
Allard	3	W	6.0	6.0
Allendale	3	P	3.5	2.5
Allis	3	P	4.5	2.5
Alluvial land	3	S	4.0	3.0
Almond	3	S	3.0	2.5
Alps	3	M	5.0	4.5
Altmar	5	M	5.0	4.5
Alton	5	W	5.5	5.5
Amboy	4	W	5.5	5.5
Amenia	4	M	5.5	5.0
Angola	2	S	4.5	3.0
Appleton	2	S	4.5	4.0
Arkport	4	W	5.5	5.5
Armagh	2	P	4.0	2.5
Arnot	3	W	4.0	4.0
Ashville	3	V	3.5	3.0
Atherton	3	P	4.0	2.5
Atkins	3	V	3.5	2.0
Atsion	5	P	4.5	3.0
Au gres	5	S	4.5	3.0
Aurelie	3	P	2.5	2.0
Aurora	2	M	4.5	4.5
Barbour	3	W	6.0	6.0
Barcelona	3	S	4.5	3.5
Barre	1	P	4.0	2.5

Soil management group (SMG; 1 through 6), drainage class (D; V=very poorly drained; P=poorly drained; S=somewhat poorly drained; M=moderately drained; W=well-drained) and alfalfa yield indices for artificially drained (DR) and undrained (UD) fields.

Name	SMG	D	YI_alfalfa (YI_a)	
			DR	UD
Bash	3	S	5.5	5.0
Basher	3	M	6.0	5.5
Bath	3	W	5.0	5.0
Becket	4	W	4.5	4.5
Becraft	3	M	6.0	5.5
Belgrade	3	M	6.0	5.5
Benson	4	E	4.0	4.0
Bergen	6	V	6.0	2.0
Berkshire	5	W	5.5	5.5
Bernardston	4	W	5.5	5.5
Berrien	5	M	5.0	4.5
Berryland	5	V	3.5	2.0
Beseman	6	V	3.5	2.5
Bice	5	W	5.0	5.0
Biddeford	2	V	3.5	2.0
Birdsall	3	V	3.5	2.5
Blasdell	3	W	5.5	5.5
Bombay	4	M	5.5	5.0
Bonaparte	4	E	4.5	4.5
Bono	1	V	4.0	3.0
Boots	6	V	3.5	2.5
Borosaprists	6	V	3.5	2.0
Boynton	3	P	4.0	2.5
Braceville	4	M	5.0	4.0
Brayton	4	S	4.5	3.0
Bridgehampton	3	W	6.0	6.0
Bridport	2	S	4.5	3.5
Briggs	4	W	5.0	5.0
Brinkerton	2	P	4.0	2.5
Broadalbin	4	M	5.5	5.5
Brockport	1	S	4.5	4.0
Brookfield	3	W	5.0	5.0
Buchanan	3	M	4.5	4.5
Buckland	3	W	4.0	0.0
Bucksport	6	V	3.5	2.0
Budd	4	W	5.5	5.5
Burdett	2	S	4.5	4.0
Burnham	3	P	3.5	2.0
Burnt Vly	6	V	3.5	2.5
Busti	3	S	4.0	3.5

Soil management group (SMG; 1 through 6), drainage class (D; V=very poorly drained; P=poorly drained; S=somewhat poorly drained; M=moderately drained; W=well-drained) and alfalfa yield indices for artificially drained (DR) and undrained (UD) fields.				
Name	SMG	D	YI_alfalfa (YI_a)	
			DR	UD
Buxton	2	M	5.5	5.0
Cambria	2	P	3.5	2.5
Cambridge	3	M	5.5	5.0
Camillus	3	W	5.0	5.0
Camroden	3	S	4.5	4.0
Canaan	4	E	4.5	4.5
Canaan rock outcrop	4	E	4.5	4.5
Canadice	2	P	4.0	3.0
Canandaigua	3	P	4.0	2.5
Canaseraga	3	M	5.5	5.0
Canastota	2	M	5.0	4.5
Caneadea	2	S	4.5	4.0
Canfield	3	M	5.0	4.5
Canton	4	W	5.5	5.5
Carbondale	6	V	3.5	2.0
Cardigan	4	W	5.0	4.0
Carlisle	6	V	3.5	2.0
Carrollton	3	W	3.5	3.5
Carver	5	E	4.0	4.0
Carver-Plymouth	5	E	4.0	4.0
Castile	4	W	5.5	5.5
Cathro	6	V	3.5	2.5
Cathro-Greenwood	6	V	3.5	2.5
Cattaraugus	3	W	5.5	5.5
Cavode	2	S	4.5	3.5
Cayuga	2	W	5.5	5.5
Cazenovia	2	M	5.5	5.5
Ceres	3	W	3.5	3.5
Ceresco	3	M	6.0	6.0
Chadakoin	3	W	5.5	5.5
Chagrin	3	W	6.0	6.0
Champlain	5	E	3.5	3.5
Charles	3	P	3.0	2.0
Charlton	4	W	5.5	5.5
Chatfield (E)	4	E	4.5	4.5
Chatfield (WE)	4	W	4.5	4.5
Chaumont	1	S	4.0	3.0
Chautauqua	3	M	5.0	5.0
Cheektowaga	5	P	4.0	3.0
Chenango	3	W	5.5	5.5

Soil management group (SMG; 1 through 6), drainage class (D; V=very poorly drained; P=poorly drained; S=somewhat poorly drained; M=moderately drained; W=well-drained) and alfalfa yield indices for artificially drained (DR) and undrained (UD) fields.				
Name	SMG	D	YI_alfalfa (YI_a)	
			DR	UD
Cheshire	4	W	5.0	5.0
Chippeny	6	V	3.5	2.0
Chippewa	3	P	4.0	2.5
Churchville	2	S	4.5	3.0
Cicero	2	S	4.5	3.5
Clarkson	2	M	6.0	5.5
Claverack	4	M	5.5	5.5
Clymer	4	W	5.0	5.0
Cohoctah	4	P	3.5	2.5
Collamer	3	M	6.0	5.5
Colonie	5	W	4.5	4.5
Colosse	4	E	4.5	4.5
Colrain	4	W	5.5	5.5
Colton	5	E	4.5	4.5
Colwood	3	P	4.0	2.5
Conesus	2	M	5.5	5.0
Conotton	3	W	5.5	5.5
Constable	5	W	4.5	4.5
Cook	5	V	3.5	2.5
Copake	4	W	6.0	6.0
Cornish	3	S	4.5	3.5
Cosad	4	S	5.0	4.0
Cossayuna	4	W	5.5	5.5
Covert	4	M	5.5	5.0
Covertfalls	4	M	5.5	5.0
Coveytown	4	S	4.5	3.0
Covington	1	P	3.5	2.5
Crary	4	M	4.5	4.0
Croghan	5	M	4.5	4.5
Culvers	3	M	5.0	4.5
Dalbo	3	M	4.5	4.5
Dalton	3	S	4.0	3.0
Danley	2	M	5.0	4.5
Dannemora	4	P	3.5	2.5
Darien	2	S	4.5	3.5
Dawson	6	V	3.5	2.5
Deerfield	5	M	4.5	4.5
Deford	4	P	4.0	4.0
Deinache	5	V	3.5	2.5
Dekalb	4	W	5.0	5.0

Soil management group (SMG; 1 through 6), drainage class (D; V=very poorly drained; P=poorly drained; S=somewhat poorly drained; M=moderately drained; W=well-drained) and alfalfa yield indices for artificially drained (DR) and undrained (UD) fields.				
Name	SMG	D	YI_alfalfa (YI_a)	
			DR	UD
Depeyster	3	M	6.0	5.5
Deposit	3	M	5.5	5.0
Derb	3	S	4.0	3.5
Dixmont	5	M	5.0	4.5
Dorval	6	V	3.5	2.0
Dover	4	W	5.5	5.5
Duane	4	M	4.5	4.0
Dunkirk	3	W	5.5	5.5
Dutchess	4	W	5.5	5.5
Duxbury	4	W	5.0	5.0
Eldred	3	M	4.0	3.5
Edwards	6	V	3.5	2.5
Eel	2	M	5.5	4.5
Eelweir	4	M	5.5	5.0
Elka	4	W	4.5	4.5
Elko	3	M	4.0	3.5
Ellery	3	P	4.0	2.5
Elmridge	5	M	5.5	4.5
Elmwood	4	M	5.0	4.5
Elnora	5	M	5.0	4.5
Empeyville	4	M	4.5	3.5
Enfield	3	W	5.5	5.5
Ensley	3	P	3.5	3.0
Erie	3	S	4.0	3.0
Ernest	3	W	4.0	4.0
Essex	5	W	4.5	4.5
Factoryville	5	E	5.0	4.5
Fahey	5	M	4.5	4.0
Farmington	3	W	4.0	4.0
Farnham	4	M	5.5	5.0
Fernlake	4	E	3.0	3.0
Flackville	4	M	5.0	4.5
Fonda	2	V	3.5	2.0
Franklinville	4	W	5.0	5.0
Fredon	4	S	4.0	3.0
Freetown	6	V	3.5	2.5
Fremont	2	S	4.5	3.0
Frenchtown	3	P	4.0	2.5
Frewsburg	3	S	4.0	3.0
Fryeburg	3	W	4.0	4.0

Soil management group (SMG; 1 through 6), drainage class (D; V=very poorly drained; P=poorly drained; S=somewhat poorly drained; M=moderately drained; W=well-drained) and alfalfa yield indices for artificially drained (DR) and undrained (UD) fields.				
Name	SMG	D	YI_alfalfa (YI_a)	
			DR	UD
Fulton	1	P	3.0	2.5
Gage	3	P	4.0	3.0
Galen	4	M	5.5	5.0
Galestown	5	E	4.0	4.0
Galoo	4	W	3.5	3.5
Galoo rock outcrop	4	W	3.5	3.5
Galway	4	W	5.0	5.0
Genesee	2	W	6.5	6.5
Geneseo	2	W	6.5	5.5
Georgia	4	M	5.5	5.0
Getzville	3	P	3.5	3.0
Gilpen	3	W	4.0	4.0
Gilpin	3	W	4.0	4.0
Glebe	4	W	3.0	3.0
Glebe-Saddleback	4	W	3.0	3.0
Glendora	4	W	3.0	3.0
Glenfield	3	V	3.5	2.5
Gloucester	4	E	4.5	4.5
Glover	4	E	3.5	3.5
Gougeville	5	V	4.0	2.0
Granby	5	P	3.5	2.0
Grattan	5	E	4.5	4.5
Greene	3	S	4.0	3.0
Greenwood	6	V	3.0	2.0
Grenville	4	W	5.5	5.5
Gretor	3	S	3.0	2.5
Groton	4	M	5.0	4.5
Groveton	4	W	5.0	4.0
Guff	1	P	3.0	2.5
Guffin	1	P	3.5	2.5
Gulf	4	P	3.5	2.5
Guyanoga	3	M	5.5	5.0
Hadley	3	W	5.0	3.5
Haights	3	W	3.5	3.0
Haights-Gulf	3	P	5.0	3.0
Hailesboro	3	S	4.0	3.5
Halcott	2	W	3.5	3.0
Halsey	4	V	6.5	2.5
Hamlin	2	W	6.5	5.5
Hamplain	2	W	5.5	4.0

Soil management group (SMG; 1 through 6), drainage class (D; V=very poorly drained; P=poorly drained; S=somewhat poorly drained; M=moderately drained; W=well-drained) and alfalfa yield indices for artificially drained (DR) and undrained (UD) fields.				
Name	SMG	D	YI_alfalfa (YI_a)	
			DR	UD
Hannawa	4	P	6.0	3.0
Hartland	4	W	6.0	6.0
Haven	4	W	6.0	3.0
Hawksnest	3	W	6.0	2.5
Hemlock	2	M	4.5	3.5
Hempstead	4	W	6.0	3.5
Henniker	4	W	5.0	4.5
Henrietta	6	V	6.0	2.0
Herkimer	3	M	5.5	5.0
Hermon	4	W	6.0	5.0
Hero	4	M	5.5	5.5
Heuvelton	2	M	6.0	4.5
Highmarket	4	W	4.5	3.5
Hilton	2	M	5.5	4.5
Hinckley	5	E	5.5	4.5
Hinesburg	4	W	5.5	5.5
Hogansburg	4	M	5.0	4.0
Hogback	5	M	4.0	4.0
Hogback-ricker	5	M	4.5	4.0
Holderton	3	S	4.5	4.0
Hollis	4	S	3.5	3.5
Holly	2	P	4.0	2.5
Holyoke	3	W	4.0	4.0
Holyoke rock outcrop	3	W	5.0	4.0
Homer	2	S	5.5	4.0
Honeoye	2	W	5.5	5.0
Hoosic	4	W	5.0	4.0
Hornell	2	S	3.0	3.0
Hornellsville	3	S	4.5	2.5
Houghtonville	5	W	4.5	4.5
Houghtonville-Rawson	5	W	4.5	4.5
Houseville	2	S	5.5	4.0
Howard	3	W	5.5	5.5
Hudson	2	M	5.0	4.5
Hulberton	2	S	4.0	4.0
Ilion	2	P	3.0	2.5
Insula	4	W	3.5	3.0
Ipswich	6	V	5.0	2.5
Ira	4	M	4.5	4.5
Ischua	3	M	4.0	3.0

Soil management group (SMG; 1 through 6), drainage class (D; V=very poorly drained; P=poorly drained; S=somewhat poorly drained; M=moderately drained; W=well-drained) and alfalfa yield indices for artificially drained (DR) and undrained (UD) fields.				
Name	SMG	D	YI_alfalfa (YI_a)	
			DR	UD
Ivory	2	S	4.0	2.5
Jebavy	5	P	4.0	3.0
Joliet	4	P	4.0	2.5
Junius	5	P	5.5	3.0
Kalurah	4	M	5.0	3.5
Kanona	2	S	5.5	2.5
Kars	4	W	5.5	3.0
Kearsarge	3	E	4.5	3.0
Kendaia	2	S	5.0	4.0
Kibbie	3	S	4.5	4.0
Kingsbury	1	S	4.5	3.5
Kinzua	3	W	4.5	4.5
Knickerbocker	5	E	5.5	4.5
Lackawanna	3	W	5.5	5.0
Lagross	3	W	5.0	5.0
Lagross-Haights	3	W	5.0	4.5
Lairdsville	2	M	4.5	3.5
Lakemont	1	P	4.0	2.5
Lakewood	5	E	4.0	4.0
Lamson	4	P	4.0	2.5
Lanesboro	3	W	5.0	4.0
Langford	3	W	5.5	4.5
Lansing	2	W	5.5	4.0
Leck kill	3	W	4.0	3.5
Leicester	4	P	4.5	2.5
Leon	5	P	4.5	3.0
Lewbath	3	W	5.5	4.5
Lewbeach	3	W	5.5	5.0
Leyden	2	M	5.5	4.5
Lima	2	M	5.0	4.5
Limerick	3	P	6.0	3.0
Linden	4	W	6.0	4.5
Linlithgo	3	S	3.5	3.0
Livingston	1	V	5.5	2.0
Lobdell	3	M	4.5	4.5
Lockport	2	S	4.5	4.0
Lorain	1	P	4.0	3.0
Lordstown	3	W	5.5	4.5
Lovewell	2	M	5.0	4.5
Lowville	4	W	5.0	3.5

Soil management group (SMG; 1 through 6), drainage class (D; V=very poorly drained; P=poorly drained; S=somewhat poorly drained; M=moderately drained; W=well-drained) and alfalfa yield indices for artificially drained (DR) and undrained (UD) fields.				
Name	SMG	D	YI_alfalfa (YI_a)	
			DR	UD
Loxley	6	V	5.5	2.5
Lucas	2	M	5.5	5.0
Ludlow	4	M	5.0	3.5
Lupton	6	V	4.0	2.5
Lyman	4	E	4.0	4.0
Lyman-Becket-Berkshire	4	E	4.0	4.0
Lyme	5	P	3.5	2.5
Lyonmounten	3	P	3.5	2.0
Lyons	2	P	5.0	2.5
Machias	4	M	4.5	3.5
Macomber	4	W	3.5	3.5
Macomber-Taconic	4	W	3.5	3.5
Madalin	1	P	5.0	2.5
Madawaska	5	M	5.5	4.5
Madrid	4	W	5.5	4.5
Malone	4	S	3.5	3.5
Manahawkin	6	V	4.0	2.5
Mandy	3	W	4.5	4.0
Manheim	2	S	4.5	3.5
Manhoning	2	S	4.5	3.0
Manlius	3	W	4.5	3.5
Mansfield	3	V	5.5	2.0
Maplecrest	2	W	5.5	4.0
Marcy	3	P	5.0	3.0
Mardin	3	M	4.5	4.5
Marilla	3	M	4.0	3.5
Markey	6	V	5.0	2.0
Marlow	4	W	5.0	3.5
Martisco	6	V	4.5	2.5
Massena	4	S	4.0	3.5
Matoon	1	S	3.0	3.0
Matunuck	6	V	3.5	2.5
Medihemists	6	V	2.5	2.0
Medina	3	W	5.0	5.0
Medomak	3	V	5.0	2.0
Melrose	4	W	5.0	3.5
Menlo	4	P	5.5	2.5
Mentor	4	W	5.5	5.0
Merrimac	4	W	5.0	4.5
Metacomet	3	M	4.5	4.0

Soil management group (SMG; 1 through 6), drainage class (D; V=very poorly drained; P=poorly drained; S=somewhat poorly drained; M=moderately drained; W=well-drained) and alfalfa yield indices for artificially drained (DR) and undrained (UD) fields.				
Name	SMG	D	YI_alfalfa (YI_a)	
			DR	UD
Middlebrook	3	M	4.5	4.0
Middlebrook-Mongaup	3	M	5.5	4.0
Middlebury	3	M	5.0	4.5
Millis	4	W	5.0	4.5
Millsite	4	W	5.5	4.5
Mineola	4	M	5.0	3.5
Miner	1	P	5.0	2.5
Mino	4	S	5.0	3.0
Minoa	4	S	5.5	3.0
Mohawk	2	W	5.5	5.0
Moira	4	M	4.0	3.5
Monadnock	4	W	4.5	3.5
Monarda	4	S	4.5	3.5
Mongaup	3	W	5.0	4.5
Montauk	4	W	5.0	3.5
Mooers	5	M	4.0	3.0
Morocco	4	P	4.5	3.0
Morris	3	S	4.5	3.5
Mosherville	4	S	3.5	3.5
Muck	6	V	3.5	2.0
Muck-peat	6	V	3.5	2.0
Mundal	4	W	4.5	3.5
Mundalite	3	W	4.5	4.5
Mundalite-Rawsonville	3	W	4.5	4.5
Munson	2	S	3.5	3.5
Munuscong	4	P	3.5	2.0
Muskego	6	V	4.5	2.0
Muskellunge	3	S	3.5	3.5
Naples Creek	3	S	4.0	4.0
Napoleon	6	V	3.5	2.0
Napoli	3	S	4.0	2.5
Nassau	4	E	4.5	4.0
Naumburg	5	S	5.0	3.0
Nehasne	4	W	5.5	5.0
Nellis	4	W	5.5	3.5
Neversink	4	P	5.5	2.0
Newfane	4	W	5.5	4.5
Newstead	4	S	3.5	3.5
Newton	5	V	5.0	2.0
Niagara	3	S	4.5	4.0

Soil management group (SMG; 1 through 6), drainage class (D; V=very poorly drained; P=poorly drained; S=somewhat poorly drained; M=moderately drained; W=well-drained) and alfalfa yield indices for artificially drained (DR) and undrained (UD) fields.				
Name	SMG	D	YI_alfalfa (YI_a)	
			DR	UD
Nicholville	4	M	6.0	4.0
Ninigret	4	M	5.5	3.5
Norchip	3	P	4.5	2.5
Northway	5	S	5.5	2.5
Norwell	5	S	3.5	3.5
Norwich	3	V	5.5	2.5
Nunda	2	M	5.0	4.5
Oakville	5	W	5.5	4.5
Oatka	2	S	4.0	4.0
Occum	4	W	5.5	4.5
Occur	4	M	5.5	5.0
Odessa	2	S	4.5	4.0
Ogdensburg	4	S	6.0	3.5
Olean	2	M	6.0	5.5
Ondawa	4	W	6.0	4.5
Oneida	4	S	4.5	3.5
Onoville	3	M	6.0	4.0
Ontario	2	W	6.0	4.5
Onteora	3	S	4.5	3.5
Ontusia	3	S	4.5	3.5
Oquaga	3	W	5.5	4.5
Oramel	2	S	5.5	3.5
Organic	6	V	4.5	2.5
Orpark	2	S	4.5	3.5
Orwell	2	P	3.5	3.0
Ossipee	6	V	5.5	2.0
Otego	2	M	5.0	4.5
Otisville	4	E	5.0	4.5
Ottawa	5	W	5.0	4.5
Ovid	2	S	4.5	4.0
Palatine	2	W	4.5	3.5
Palms	6	V	5.5	2.5
Palmyra	3	W	5.5	4.5
Panton	1	P	3.5	3.5
Papakating	2	P	5.0	2.5
Parishville	4	M	4.0	3.5
Parsippany	1	P	3.5	2.5
Patchin	3	P	3.5	2.5
Pavilion	4	P	5.5	2.5
Pawcatuck	6	V	5.5	2.5

Soil management group (SMG; 1 through 6), drainage class (D; V=very poorly drained; P=poorly drained; S=somewhat poorly drained; M=moderately drained; W=well-drained) and alfalfa yield indices for artificially drained (DR) and undrained (UD) fields.				
Name	SMG	D	YI_alfalfa (YI_a)	
			DR	UD
Pawling	4	M	5.5	5.0
Paxton	4	W	5.0	3.0
Peacham	3	P	3.5	2.0
Peasleeville	4	S	5.0	3.0
Peat	6	V	3.5	2.5
Peat-muck	6	V	5.0	2.0
Peru	4	M	5.5	4.5
Petoskey	4	W	5.5	5.5
Phelps	3	M	6.0	5.0
Philo	3	M	5.5	4.0
Pillsbury	4	S	4.5	2.5
Pinckney	3	M	4.5	4.0
Pipestone	5	S	5.5	2.5
Pittsfield	4	W	5.5	5.5
Pittstown	4	M	5.0	3.0
Plainbo	5	E	4.5	3.0
Plainfield	5	E	4.5	4.0
Plessis	3	S	4.0	3.5
Plymouth	4	E	6.0	4.0
Podunk	4	M	5.5	5.5
Poland	2	W	5.5	5.0
Pompton	4	M	5.5	4.5
Pootatuck	4	M	5.5	5.0
Pope	4	W	5.5	5.0
Portville	3	S	5.0	3.5
Potsdam	4	W	5.0	3.0
Poygan	1	V	4.5	2.0
Punsit	3	S	5.5	3.0
Pyrities	4	W	5.5	3.0
Quetico	4	W	3.0	3.0
Quetico-rock outcrop	4	W	5.0	3.0
Raquette	4	S	4.0	4.0
Rawsonville	5	W	4.0	4.0
Rawsonville-Beseman	5	W	5.0	4.0
Rayne	3	W	5.0	4.5
Raynham	3	S	3.5	3.5
Raypol	3	P	4.5	2.5
Red hook	4	S	5.5	3.5
Redwater	3	S	4.5	4.5
Remsen	2	S	4.5	3.0

Soil management group (SMG; 1 through 6), drainage class (D; V=very poorly drained; P=poorly drained; S=somewhat poorly drained; M=moderately drained; W=well-drained) and alfalfa yield indices for artificially drained (DR) and undrained (UD) fields.				
Name	SMG	D	YI_alfalfa (YI_a)	
			DR	UD
Retsof	2	S	4.5	3.5
Rexford	4	S	4.5	3.0
Rhinebeck	2	S	4.0	4.0
Ricker	4	E	4.0	4.0
Ricker-Lyman	4	E	4.0	4.0
Ridgebury	4	P	3.5	3.0
Rifle	6	V	4.5	2.5
Riga	2	M	4.5	3.5
Rippowam	4	P	5.5	2.5
Riverhead	4	W	5.5	4.5
Rockaway	2	W	5.5	4.0
Romulus	2	P	6.0	3.0
Ross	2	W	6.0	4.0
Roundabout	3	S	4.0	3.5
Rumney	2	P	3.0	2.0
Runeberg	4	P	3.5	2.0
Ruse	4	P	5.0	2.5
Rushford	3	M	4.5	3.0
Saco	3	V	4.5	2.0
Salamanca	3	M	5.0	4.0
Salmon	4	W	5.0	3.5
Saprists	6	V	4.5	2.0
Saugatuck	5	S	4.5	3.0
Scantic	2	P	4.0	3.0
Scarboro	4	P	5.0	2.5
Schoharie	1	M	5.0	5.0
Schroon	5	M	5.0	5.0
Schuyler	3	M	5.5	4.5
Scio	3	M	5.0	4.5
Sciota	5	M	5.0	4.5
Scituate	4	M	4.5	4.5
Scriba	4	S	4.0	3.5
Searsport	4	P	4.5	2.5
Shaker	2	P	3.5	3.5
Sheddenbrook	5	M	4.5	4.0
Shongo	3	S	4.0	2.5
Shoreham	2	V	3.5	2.0
Sisk	4	V	4.5	2.0
Skerry	5	M	4.0	3.5
Sloan	3	V	5.0	2.0

Soil management group (SMG; 1 through 6), drainage class (D; V=very poorly drained; P=poorly drained; S=somewhat poorly drained; M=moderately drained; W=well-drained) and alfalfa yield indices for artificially drained (DR) and undrained (UD) fields.				
Name	SMG	D	YI_alfalfa (YI_a)	
			DR	UD
Sodus	4	W	5.0	4.6
Somerset	5	P	4.0	3.0
St johns	4	P	4.0	2.5
Staatsburg	3	W	4.5	4.0
Stafford	4	S	4.5	3.5
Steamburg	3	M	5.0	4.0
Stetson	5	W	5.0	4.0
Stissing	4	P	5.5	2.5
Stockbridge	3	W	5.5	4.0
Stockholm	5	P	4.5	3.0
Stowe	4	W	5.0	4.5
Sudbury	4	M	5.5	4.0
Suffield	2	M	5.0	3.0
Summerville	4	E	4.0	3.5
Sun	4	V	4.5	2.5
Sunapee	4	M	3.5	3.0
Suncook	5	E	3.4	3.0
Suny	4	P	3.5	2.0
Surplus	4	V	3.5	2.0
Surplus-Sisk	4	V	5.0	2.0
Sutton	4	M	5.0	4.5
Swanton	4	P	5.0	3.0
Swartswood	4	W	5.0	4.5
Swormville	1	S	3.5	3.0
Taconic	3	W	3.5	3.5
Taconic-Macomber	3	W	3.5	3.5
Tawas	6	V	5.5	2.5
Teel	2	M	4.5	3.5
Tioga	3	W	6.0	6.0
Toledo	2	V	4.5	2.0
Tonawanda	2	S	3.5	3.0
Tor	4	S	4.0	2.0
Torull	3	S	5.0	3.0
Towerville	3	M	5.5	4.5
Trestle	3	W	5.5	4.0
Trout river	5	E	5.5	4.0
Troy	3	M	5.0	3.5
Trumbull	1	P	3.5	2.5
Tughill	4	V	4.0	2.5
Tuller	3	S	4.5	3.5

Soil management group (SMG; 1 through 6), drainage class (D; V=very poorly drained; P=poorly drained; S=somewhat poorly drained; M=moderately drained; W=well-drained) and alfalfa yield indices for artificially drained (DR) and undrained (UD) fields.				
Name	SMG	D	YI_alfalfa (YI_a)	
			DR	UD
Tunbridge	4	W	4.5	4.5
Tunbridge-Adirondack	4	W	5.5	4.5
Tunkhannock	3	W	5.5	4.5
Turin	2	S	5.5	3.0
Tuscarora	4	M	6.0	5.5
Unadilla	3	W	6.0	5.5
Valois	3	W	5.5	3.5
Varick	2	P	5.5	2.5
Varysburg	2	W	5.5	4.5
Venango	3	S	5.0	3.5
Vergennes	1	M	4.5	4.0
Vly	3	W	4.5	4.0
Volusia	3	S	5.0	3.5
Waddington	4	W	5.0	4.5
Wainola	5	S	4.5	3.0
Wakeland	3	S	5.0	3.5
Wakeville	3	S	4.0	4.0
Wallace	5	E	4.5	4.0
Wallington	3	S	4.0	3.5
Wallkill	3	V	4.5	2.0
Walpole	4	P	5.5	3.0
Walton	3	W	5.5	5.5
Wampsville	3	W	6.0	5.5
Wappinger	3	W	6.0	4.5
Wareham	5	P	3.5	3.0
Warners	3	V	4.5	2.0
Wassaic	4	M	4.5	4.0
Watchaug	4	M	4.5	3.0
Waumbeck	4	M	3.5	3.0
Wayland	2	P	4.5	2.5
Weaver	3	M	4.0	3.5
Wegatchie	3	P	5.0	2.5
Wellsboro	3	M	5.0	4.5
Wenonah	4	W	5.0	4.5
Westbury	4	S	3.5	3.0
Westland	2	V	5.5	2.5
Wethersfield	4	W	5.5	5.0
Wharton	2	M	4.5	3.5
Whately	4	V	4.5	2.0
Whippany	2	S	5.5	3.5

Soil management group (SMG; 1 through 6), drainage class (D; V=very poorly drained; P=poorly drained; S=somewhat poorly drained; M=moderately drained; W=well-drained) and alfalfa yield indices for artificially drained (DR) and undrained (UD) fields.				
Name	SMG	D	YI_alfalfa (YI_a)	
			DR	UD
Whitelaw	4	W	5.5	3.5
Whitman	4	V	4.5	2.0
Wilbraham	4	S	5.0	3.0
Willdin	3	M	4.5	3.5
Willette	6	V	5.0	2.5
Williamson	4	M	5.0	4.5
Willowemoc	3	M	4.5	4.0
Wilmington	4	P	5.0	2.5
Wilpoint	1	M	4.5	4.0
Windsor	5	E	5.0	4.5
Winooski	4	M	5.0	3.5
Wiscoy	3	S	5.0	3.5
Wolcottsburg	1	P	3.5	2.5
Wonsqueak	6	V	5.0	2.0
Woodbridge	4	M	4.5	4.5
Woodlawn	4	W	4.5	4.0
Woodstock	4	E	4.0	4.0
Woodstock-rock outcrop	4	E	5.0	4.0
Wooster	3	W	5.5	5.0
Woostern	3	W	5.5	5.5
Woostern-Bath-Valois	3	W	5.5	3.5
Worden	4	S	4.5	2.0
Worth	4	W	4.5	4.5
Wurtsboro	4	M	4.0	4.0
Wyalusing	3	P	5.0	3.0
Yalesville	4	W	5.0	4.0
Yorkshire	3	M	4.0	3.5

Appendix C: Potassium guidelines for corn silage, grain corn, millet, sorghum forage, sorghum grain, sorghum-sudan hybrids, sudangrass, sunflowers. See section 5.1 for equations to derive potassium guidelines (crop codes: COS, COG, MIL, SOF, SOG, SSH, SUD, SUN).

Cornell Morgan STK	K recommendation (lbs K_2O/acre)									
	COS and COG Soil Management Group					MIL, SOF, SOG, SSH, SUD, SUN Soil Management Group				
lbs K/acre	1	2	3	4	5/6	1	2	3	4	5/6
≤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 D: Potassium guidelines for alfalfa, birdsfoot trefoil, clover, pasture, rye seed. See sections 5.3 and 5.4 for equations to derive potassium guidelines (crop codes: ALT, AGT, ABT, BCT, CGT, BST, BTT, GIT, GRT, PNT, RYS).

Cornell Morgan soil test K	K recommendation				
	Soil Management Group (SMG)				
	1	2	3	4	5/6
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
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

Cornell Morgan soil test K	K recommendation				
	Soil Management Group (SMG)				
	1	2	3	4	5/6
lbs K/acre	----------lbs K_2O/acre----------				
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
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

Cornell Morgan soil test K	K recommendation				
	Soil Management Group (SMG)				
	1	2	3	4	5/6
lbs K/acre	----------lbs K_2O/acre----------				
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

Appendix E: Potassium guidelines for barley, oats, wheat. See section 5.5 for equations to derive potassium guidelines (crop codes: BSP, BWI, OAT, WHT).

Cornell Morgan soil test K	K recommendation
lbs K/acre	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
>165	0

Appendix F: Potassium guidelines for buckwheat and rye cover crop. See section 5.6 for equations to derive potassium guidelines (crop codes: BUK, RYC).

Cornell Morgan soil test K	K recommendation
lbs K/acre	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 G: Potassium recommendations for triticale peas. See section 5.7 for equations to derive potassium guidelines (crop code: TRP).

Cornell Morgan soil test K	K recommendation
lbs K/acre	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