

DCR Technical Guide Work Group

October 19, 2026 at 9:30 am

2748 Dogtown Rd.,
Goochland, VA 23063

Agenda

9:30 am: Introductions

9:45 am: Review of Technical Documents

10:30 am: Open Discussion

12pm: Lunch

1pm: Open Discussion

3pm: Conclude Session; safe travels!

Commonwealth of Virginia

Virginia Nutrient Management
Agriculture Crop Needs
Technical Document
Revised **TBD**

Department of Conservation and Recreation
Division of Soil and Water Conservation
600 East Main Street, 4th floor
Richmond, VA 23219

**DRAFT TO BE NAMED TECHNICAL DOCUMENT
Agriculture Crop Nutrient Needs**

Insert TOC Listing Each Crop

Reformat to have the following groupings (as they're in no order now)

Row crops, ending with small grain madness

Hay

Pasture

Hay/Pasture

Specialty (Trees)

Insert Information about Using OUTSIDE, but DCR APPROVED, resources

Copied from page 60 of S&C 2014 Phosphorus and potash soil test levels in this table are based on Mehlich I soil test results. Only soil test levels correlated to Mehlich I using methods contained in this document are acceptable.

Copied from page 2 of S&C 2014 Micronutrient or trace element recommendations should be made using Virginia Tech Soil Test Note 4: Trace Elements, (Publication 452-234) or the Commercial Vegetable Production Recommendations 2005 (Publication 456-420). With the exception of boron, micronutrient recommendations should be based on soil test levels.

Corn Grain Nutrient Needs*

<u>Productivity Group</u>	<u>N - Nutrient Needs</u>
IA	180
IB	170
IIA	160
IIB	150
IIIA	140
IIIB	130
IVA	120
IVB	100
V	80

*See nitrogen management recommendations for Corn.

Soil Productivity Groups I , II

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>	
	<u>P₂O₅</u>	<u>K₂O</u>
L	100-140	100-140
M	60-100	60-100
H	20-60	20-60
VH	0	0

Soil Productivity Groups III, IV, V

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>	
	<u>P₂O₅</u>	<u>K₂O</u>
L	80 -120	80 -120
M	40 - 80	40 - 80
H	20 - 40	20 - 40
VH	0	0

Corn Silage Nutrient Needs*

<u>Productivity Group</u>	<u>N - Nutrient Needs (a)</u>
IA	200
IB	185
IIA	175
IIB	165
IIIA	155
IIIB	145
IVA	130
IVB	110
V	90

*See nitrogen management recommendations for Corn.

Soil Productivity Groups I , II

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>	
	<u>P₂O₅</u>	<u>K₂O</u>
L	140-200	240-300
M	100-140	180-240
H	40-100	100-180
VH	0	0

Soil Productivity Groups III , VI, V

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>	
	<u>P₂O₅</u>	<u>K₂O</u>
L	120-160	200-240
M	80-120	140-200
H	40-80	60-140
VH	0	0

When using documented farmer records, corn silage yield may be calculated using the following formula:
 Corn Grain Yield (bu/ac) X 0.0985 + 7.6964 = **Corn Silage Yield** Tons/acre.

Nitrogen Management Recommendations for Corn

On soils with a High nitrogen loss risk, at least 50% of the inorganic nitrogen applications shall be applied as a sidedress application. On Moderate and Low nitrogen loss risk soils this management method is preferred, but not required. The combination of row starter, at planting nitrogen applications and sidedress applications cannot exceed the nitrogen need listed for that crop in that field.

It is recommended that fields which contain high environmental risk soils for nitrogen loss where organic nutrient sources are used to meet most of the nitrogen need for corn should include a split application of nitrogen which is at least 33% of the nitrogen needs to be applied as a sidedress application. If no pre-plant nitrogen will be broadcast and planting conditions exist where the cold soil temperatures may be limiting mineralization of nitrogen, starter nitrogen may aid in plant establishment and early season growth. The combination of row starter, at planting nitrogen applications, plant available nitrogen supplied from organic sources, and sidedress applications cannot exceed the nitrogen need listed for that crop in that field.

For cereal silage/corn silage rotations only, 20 lbs/acre of nitrogen may be applied as part of a banded starter application at planting, in addition to the nitrogen need designated for the field. IF no starter is applied as a banded application, only the nitrogen need designated for the field shall be recommended.

To determine nitrogen needs for corn yields above those listed in Table 1-2, Estimated Yields in Bushels or Tons per Acre of Various Non-Irrigated Crops for Identified Soil Productivity Groups, use 1 lb of nitrogen per bushel for grain yields, and 1.1 lbs of nitrogen per bushel of grain yield for silage corn tonnage converted back to bushels using the formula:

$$\frac{(\text{corn silage tons/acre} - 7.6964)}{0.0985} = \text{Corn grain yield}$$

Irrigated Corn

These expected yields and nitrogen recommendations in the table below should not be used for fields where manure is applied through an irrigation system unless supplemental clean water irrigation is utilized, since manure applications should usually occur prior to the times of peak moisture demand by crops to allow time for mineralization. Irrigated nitrogen recommendations shall only be used when the water source can supply at least 6 inches of water to the entire field per growing season.

Corn Grain production using Center Pivot Irrigation *

Soil Management Groups	Expected Corn Yield, Bu/Ac	N - Nutrient Needs
A,B,D	210	210
C,E,F,G,J,K,L,M,N,O,Q,R,S,T	200	200
I,DD	190	190
V,W,X	180	180
AA,BB,II	170	170
Y	160	160
KK	140	140

Soil Test Level

Nutrient Needs (lbs/ac)

	<u>P₂O₅</u>	<u>K₂O</u>
L	130 - 170	130 - 170
M	80 - 120	80 - 120
H	30 - 70	30 - 70
VH	0	0

*An adjustment to irrigated grain yields is needed for traveling gun systems, because typically yield response will be highly variable depending upon management of the system. A reasonable estimate of planning yield is 90% of the above estimates for properly scheduled irrigation.

Corn Silage Production using Traveling Gun Irrigation

Soil Management Groups	Expected Corn Yield, Tons/Ac	N - Nutrient Needs
A,B,D	26.3	210
C,E,F,G,J,K,L,M,N,O,Q,R,S,T	25.4	200
I,DD	24.5	190
V,W,X	23.6	180
AA,BB,II	22.7	170
Y	21.9	160
KK	20.1	140

Soil Test Level

Nutrient Needs (lbs/ac)

	<u>P₂O₅</u>	<u>K₂O</u>
L	140-200	240-300
M	100-140	180-240
H	40-100	100-180
VH	0	0

Notes for all irrigated corn silage and corn grain fields:

Irrigation of soils in the following soil management groups is not recommended; factors other than water-holding capacity may be the yield limiting factor; H, P, U, Z, CC, EE, FF, GG, HH, LL, MM, NN, OO, PP, QQ. Use dryland yields in Table 1-2.

Nitrogen use efficiency by irrigated corn can be increased by splitting the total sidedress rate of nitrogen into two applications, with the second of the two applications occurring just before the corn is too tall to drive through with the application equipment. If this second application is applied through the irrigation system, it should be applied about 7-10 days before silking, or split into smaller multiple applications.

Pre-Sidedress Soil Nitrate Test (PSNT)

Sample collection essentials for PSNT for corn:

Select fields where organic sources of nitrogen have been applied, according to the timing criteria listed in the Virginia Nutrient Management Training and Certification Regulations under Nutrient Application Timing, to supply nitrogen to the present corn crop

Sample collection - At least 10-20 cores per field, 12 inches deep, between rows to avoid starter bands and areas where roots have not depleted nitrogen.

Sample time - corn should be 10" to 15" tall at the whorl as it stands, **NOT** to the tallest part of the plant.

Only **one** of the following options can be used to determine sidedress rate adjustment in any one season, based on the criteria outlined for each option.

Option 1 - Adjustment of Nitrogen Sidedress Recommendations

Nitrogen needs and timing of applications for corn shall be calculated based on criteria outlined in Section VAC 5-15-150.A.2.e. of the Virginia Nutrient Management Training and Certification Regulations. When organic nutrient sources have been used to supply a significant portion of the nitrogen need in present or past years and a nitrogen sidedress application rate has been recommended, the PSNT results and the guidance below shall be used to adjust the sidedress rate when applicable. This guidance should be used as one factor along with rate of organic material applied, field history, seasonal conditions, and an understanding of the effects of soil properties and management practices related to nitrogen availability to corn. All these factors need to be considered to adjust the sidedress nitrogen rate stated in the nutrient management plan to improve the economics of crop production and to enhance water quality.

Nitrate-N Conc.	N Rate Recommendation
< 11 ppm	Apply full rate of sidedress N that is specified for the field in the nutrient management plan.
11-20 ppm	Apply 50 - 75% of sidedress N that is specified for the field in the nutrient management plan. The decision to reduce the recommended nitrogen rate must be made on a site-by site basis and should take into account previous field history, organic N additions, and management practices.
> 20 ppm	Nitrate nitrogen at a level to meet the yield goal without any sidedress nitrogen needed.

Option 2 - Adjustment of Nitrogen Sidedress Recommendations Considering suspected high nitrogen leaching loss or low mineralization of organic nitrogen sources(s).

If: (a) extreme weather conditions occur, such as two or more rainfall events exceeding 2 inches since the nitrogen application, which have caused significant amounts of nitrogen to be leached below the root zone, or (b) mineralization of organic nitrogen sources are much lower than expected, a one time corrective nitrogen sidedress application can be made consistent with the following table **if:** a) nitrogen applications have been made such that rate and timing of applications have been consistent with the criteria in 4VAC 5-15-150, b) and corn shows visual signs of nitrogen deficiency, c) and a PSNT indicates NO₃-N is below 20 ppm in the top 12" of the soil profile.

Nitrate-N Conc.	N Rate Recommendation
< 6 ppm	Apply planned sidedress N that is specified for the field OR 70% of the nitrogen needs shown in the nutrient management plan for that field, whichever is greater.
6 - 11 ppm	Apply planned sidedress N that is specified for the field OR 40% of the nitrogen needs shown in the nutrient management plan for that field, which ever is greater.
12 - 20 ppm	Apply 50 - 75% of sidedress N that is specified for the field OR 30% of the nitrogen needs shown in the nutrient management plan for that field.
> 20 ppm	Nitrate nitrogen at a level to meet the yield goal without any sidedress nitrogen needed.

Grain Sorghum

<u>Productivity Group</u>	<u>Nitrogen Needs</u>
IA	140
IB	130
IIA	120
IIB	110
IIIA	100
IIIB	90
IVA	90
IVB	90
V	80

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>	
	<u>P₂O₅</u>	<u>K₂O</u>
L	80 -120	80 -120
M	40 - 80	40 - 80
H	20 - 40	20 - 40
VH	0	0

Soybeans - All Productivity Groups

Soil Test Level

L
M
H
VH

Nutrient Needs (lbs/ac)

P₂O₅

80 - 120
40 - 80
20 - 40
0

K₂O

80 - 120
40 - 80
20 - 40
0

REFORMAT ALL OF SMALL GRAINS!!!

Small Grain Management Options: Choose nutrient needs based on the intended use of the crop by the farmer.

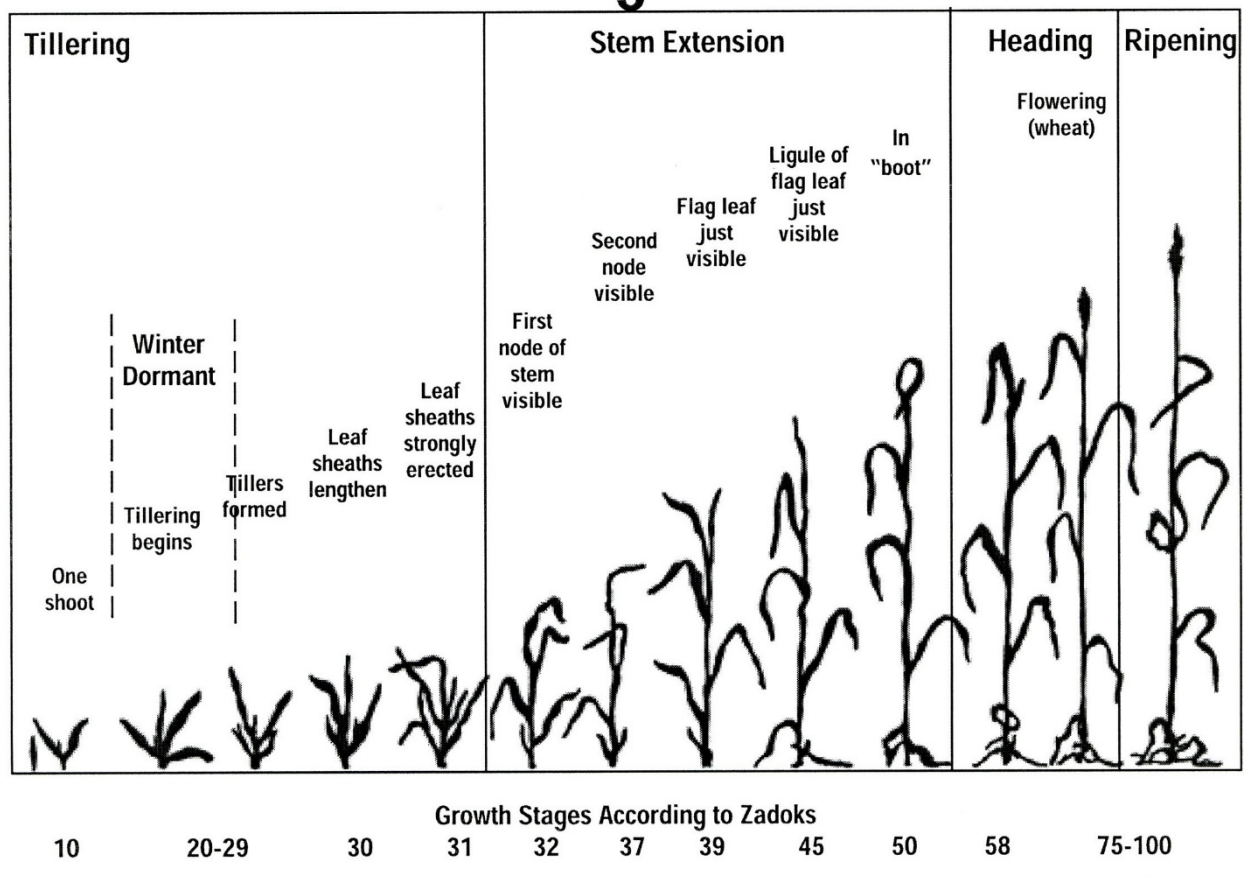
1. **Small Grain Silage** - this crop is planted for the intended purpose of harvest in early spring for silage. Similar fall tiller management practices should be applied as used in Standard/Intensive Management of Wheat and Barley.
2. **Wheat and Barley**- Standard/Intensive Grain Production- this crop is to be managed based on a program to maximize grain yield by planting within the window of acceptable dates according to location within the state, careful tiller management through the fall and winter months and spring split application rates of nitrogen based on tiller counts and tissue tests.
3. **Cover Crop** - this crop is grown for the purpose of scavenging any residual nitrogen from the previous crop due to lower than expected yield, or mineralization of organic nutrient materials applied to the previous crop is expected to occur after the crop is harvested. Cover crop may also be used to manage on farm manure storage facilities by application of low rates of manure in the fall and winter when needed.
4. **Trap Crop** - the sole purpose of this crop is to provide fields which can receive manure, biosolids, or other organic nutrient source applications through the fall and winter months for management of limited storage facilities of these materials.

This is a less desirable option because the nitrogen need for the following spring crop, or some part of the nitrogen need, may be used to determine rate of nitrogen for the winter application. **IF** the intention is to base the application rate of nitrogen on the total nitrogen need of the following spring crop, then application shall be in compliance with Timing of Organic Nutrient Sources in Section I.A and at least 30 pounds of nitrogen need must be withheld at the time of application to be used as part of a banded starter at planting. Also, all phosphorus applied through this application will be credited to the Spring crop or to the phosphorus application of the rotation.

The only purpose of the trap crop is for the management of organic nutrient sources where limited or no storage facilities are available. Fall or winter application of a nitrogen rate based on a spring crop, commits the farmer to planting that crop in a timely manner to assure successful establishment of the intended spring crop.

Zadoks Scale of Small Grain Growth Stages

Many nutrient applications are based on timing related to the growth stage of the small grain crop. The figure below is provided as reference for planners when writing plans and explaining application times to clients.



Detailed description of pertinent nutrient management program Growth Stages are:

- GS 23 - Main Shoot and 3 Tillers
- GS 25 - Main Shoot and 5 Tillers
- GS 30 - Leaf Sheaths lengthened with Erect Stems

A tiller may be counted when it has three fully developed leaves on its stem.

Nutrient Recommendations by Small Grain Program

Cover Crop

Crop should be planted early enough in the fall to be quickly established after the harvested crop. The main purpose of the Cover Crop is to scavenge residual nitrogen from the previous crop. However, fields designated to be planted to a cover crop may also be used to spread manure at low rates (less than 40 pounds of nitrogen) through the fall and winter to properly manage on farm storage manure facilities, to assure adequate storage capacity is available until the spring applications can begin.

1. Eligible Fields:

- a. Acceptable small grains are barley, wheat, rye, triticale
- b. Seeding of all seed types must be established by the dates indicated in the table below.

<u>Region</u>	<u>Established Date</u>
Cities of Chesapeake & VA Beach	November 30
Coastal Plain	November 15
Piedmont	November 1
Mountain and Valley	October 25

2. Fall - Winter Nitrogen Rates

Nitrogen rates will be calculated using Spring or early Fall applied coefficients for manures and Year of Application coefficient for biosolids to calculate the PAN for the organic fraction and appropriate coefficient for PAN ammonium fraction for all materials.

Nitrogen rate for application to manage on farm manure storage facilities:

<u>Nutrient Needs (lbs/ac)</u>		
<u>Nitrogen</u>	<u>P₂O₅</u>	<u>K₂O</u>
0-40	0	0

All phosphorus applied through this application will be credited to the spring crop or the phosphorus application of the rotation.

3. Late Winter - Early Spring Nitrogen Rates

- a. Cover crop will be killed before Spring crop is planted - No Nitrogen applied

OR

If at any time the management of this crop is changed from the original cover crop status, then the following nitrogen management recommendations shall be used. Performance and final yield of this crop may not be comparable to proper management of the specific crop outlined in other parts of this booklet.

NOTE: This change in management of the cover crop will affect eligibility for state and/or federal cost-share payments.

- a. Cover crop will be harvested for silage:

Triticale - Maximum of 70 lbs/ac.

Rye - Maximum of 70 lbs/ac.

Wheat - Maximum of 60 lbs/ac.

Barley - Maximum of 50 lbs/ac.

OR

- b. Cover crop will be harvested for grain - Follow recommendations in table below.
Warning - Using maximum N rates listed in table below may cause lodging of crop when a high rate of Nitrogen was applied in the Fall.

(Feb. - Early March)	Tiller Count:	N Application Program
Single Application:	<70/sq. ft.	80 lbs/acre-Feb.(Growth Stage 25)
	>100; plants dark green; tissue N levels >3.75%	30-40 lbs/acre-late March (Zadoks Growth Stage 30)
Split Application:		
February (Zadoks Growth Stage 25)	<60/sq. ft.	60 lbs N/acre
	60-100/sq. ft.	40 lbs N/acre
	>100/sq. ft. and dark green color	none; tissue test at growth stage 30
March (growth stage 30 tissue test)		No more than 120 lbs N/acre; <u>the total of Growth Stages 25 and 30</u>

Trap Crop

Nutrient Needs (lbs/ac)*		
<u>Nitrogen</u>	<u>P₂O₅</u>	<u>K₂O</u>
<u>0</u>	<u>0</u>	<u>0</u>

*Specific to the Trap Crop itself.

The purpose of the following recommendations are to provide fields which can receive manure, biosolids and other organic nutrient source applications through the fall and winter months if the priority is for management of limited storage facilities, rather than achieving expected yield of future crops. Applications shall not occur before the trap crop reaches Zadoks growth stage 23 (one main shoot and 3 tillers) or greater AND having a uniform stand throughout the entire area to be spread of at least 20 plants per square foot. Application rate shall not exceed the nutrient needs described below and shall not smother the crop. Application shall only occur when the spreading equipment and associated operations will cause minimal damage to the crop during application.

Nitrogen rate for application based on Spring Crop nitrogen needs:

Nitrogen needs of spring crop to be planted minus at least 30 pounds of nitrogen to be applied as a banded application at planting.

Nitrogen rates will be calculated using Spring or Early Fall Applied coefficients for manures and Year of Application coefficient for biosolids to calculate the PAN for the organic fraction and appropriate coefficient for PAN ammonium fraction for all materials.

No more nitrogen shall be applied to the trap crop or the following spring crop using this option, with the exception of the amount of nitrogen deducted from the nitrogen needs at the time of application. This remaining nitrogen shall be applied as a banded application at planting of the spring crop. It should be noted that this program of nitrogen application may result in a lack of adequate nitrogen available to the spring crop to produce the expected yield. Less than adequate nitrogen would be due to immobilization of nitrogen by the trap crop and loss of the applied nitrogen through runoff and leaching.

All phosphorus applied though this application will be credited to the spring crop or the phosphorus application of the rotation.

Rye Grown for Grain

1. Soil productivity groups are the same as for wheat and barley
2. Nitrogen recommendations:
 - a. At planting - 25-30 lbs N/acre
 - b. Late winter - a single application made in February
 - (1) For grain production - 45 lbs N/acre

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>	
	<u>P₂O₅</u>	<u>K₂O</u>
L	80 - 120	80 - 120
M	40 - 80	40 - 80
H	20 - 40	20 - 40
VH	0	0

Small Grain for Silage

1. Soil productivity groups are the same as for wheat and barley
2. Nitrogen recommendations:
 - a. At planting - 0-30 lbs N/acre
 - use lower rate on fields, which will be timely planted, with a history of frequent manure applications, and good growing conditions are expected 10 days after planting.
 - b. Late winter - a single application made in February
 - (1) Triticale, Rye, Wheat silage production - 40-90 lbs N/acre
 - (2) Barley, Oats silage production - 40-70 lbs N/acre
 - (a) Preferred application period would be after green-up occurs and before first joint has emerged.
 - (b) Use lower rates on field which are well established, have dark green color, and a history of lodging.

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>	
	<u>P₂O₅</u>	<u>K₂O</u>
L	80 - 120	80 - 120
M	40 - 80	40 - 80
H	20 - 40	20 - 40
VH	0	0

Wheat and Barley for Grain - Nitrogen Management Applications

Standard/Intensive

1. At planting:
 - a. With NO_3^- soil test from top 6 inches measuring above 30 ppm, no nitrogen needed at planting.
 - b. If soil test is below 30 ppm, apply 15-30 pounds of nitrogen.
 - c. Without NO_3^- soil test results:
 - (1) Conventional tillage: broadcast and incorporate 1-2 inches, 25-30 lbs N/acre during land preparation for planting. Reduce N application if high residual N levels are expected.
 - (2) No-till: broadcast 30-40 lbs N/acre shortly before planting, if heavy residue (60% or greater cover) is present. Follow N recommendations for conventional planting if light residue (less than 60% cover) or no residue is present.

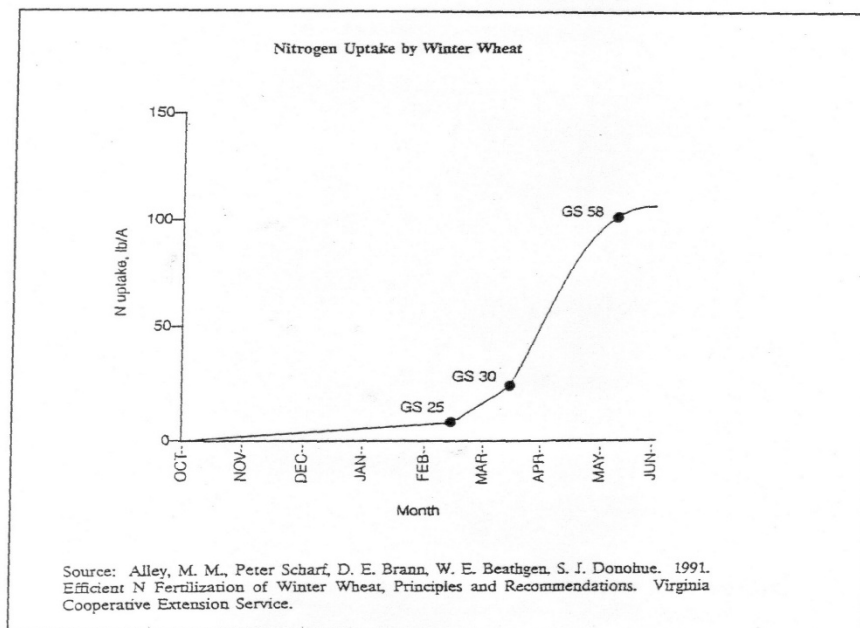
Intensive Management Only

2. Midwinter (December-January)

If:

- a. Significant leaching rains have occurred during the October-December period, i.e., two or more rainfall events of 2.0 inches or more, and
- b. there has been very little tiller development, i.e., less than 3 tillers per plant, and the crop has a pale green color, and
- c. there is an expectation of several days during January and February when maximum daily temperature will exceed 50°F; **apply:** 30 lbs N/acre as a topdress.

Figure 5-1



Management of Spring Nitrogen

3. Late Winter (February-early March)

a. Single Spring application of N, (Standard management):

- (1) Fields with less than 70 tillers per sq.ft., **apply** 80 lbs/acre in February. Fertilize those fields with less than 60 tillers per sq.ft. first.

OR

- (2) Fields with 70 to 100 tillers per sq.ft., and plants are pale green and tissue test levels are lower than 3.75%, **apply**: 60 lbs/acre in February.

OR

- (3) Fields have 70 to 100 tillers per sq.ft., plants are dark green and N tissue test levels are 3.75% or higher, **apply**: 30-40 lbs/acre in late March (Zadoks growth stage 30.)

OR

- (4) Fields have more than 100 tillers per sq.ft., plants are dark green and tissue test levels are 3.75% or higher **apply**: 30-40 lbs/acre in late March (Zadoks growth stage 30.)

b. Split applications of Spring N (Intensive small grain management):

- (1) February (Zadoks growth stage 25.)

- (a) Fields with less than 60 tillers per sq. ft. - apply 60 lbs N/acre.

OR

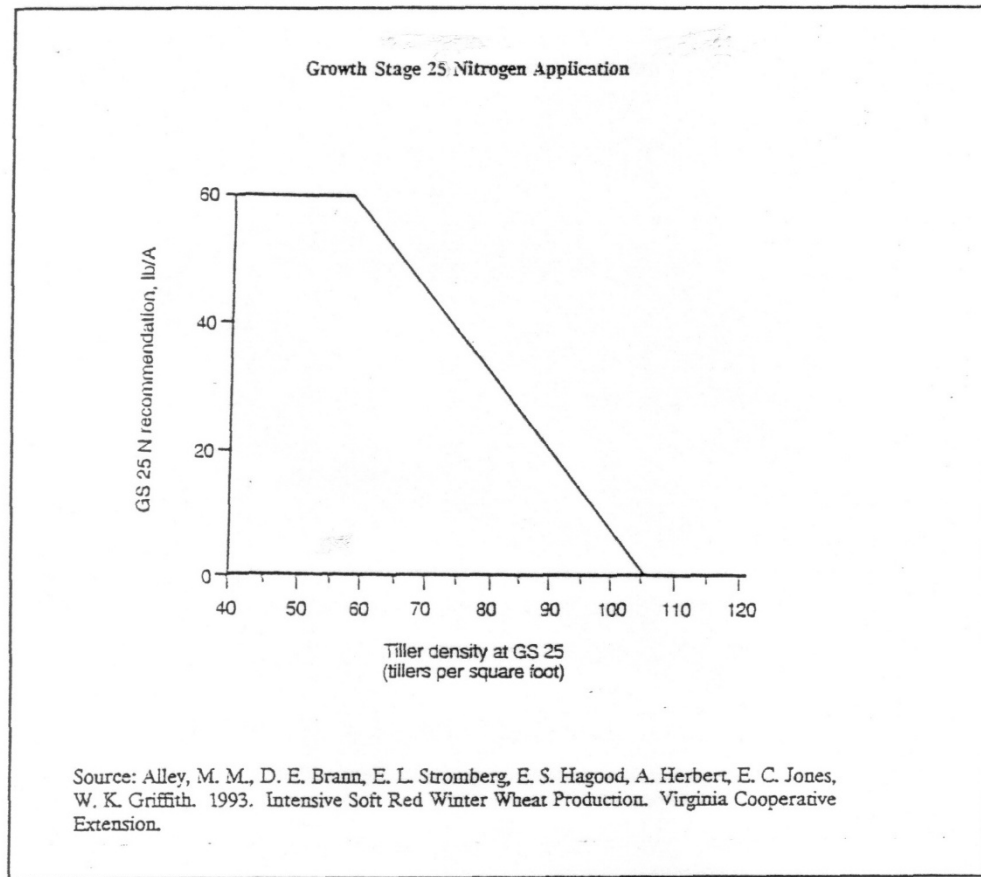
- (b) Fields with 60 to 100 tillers per sq. ft. - apply 40 lb N/acre.

OR

- (c) Fields with more than 100 tillers per sq. ft. and the crop has a good green color - do not apply nitrogen at this time. Tissue test at Zadoks growth stage 30 to determine N application needs.

Use **Figure 5-2** for more detailed nitrogen application rates based on exact tiller counts.

Figure 5-2

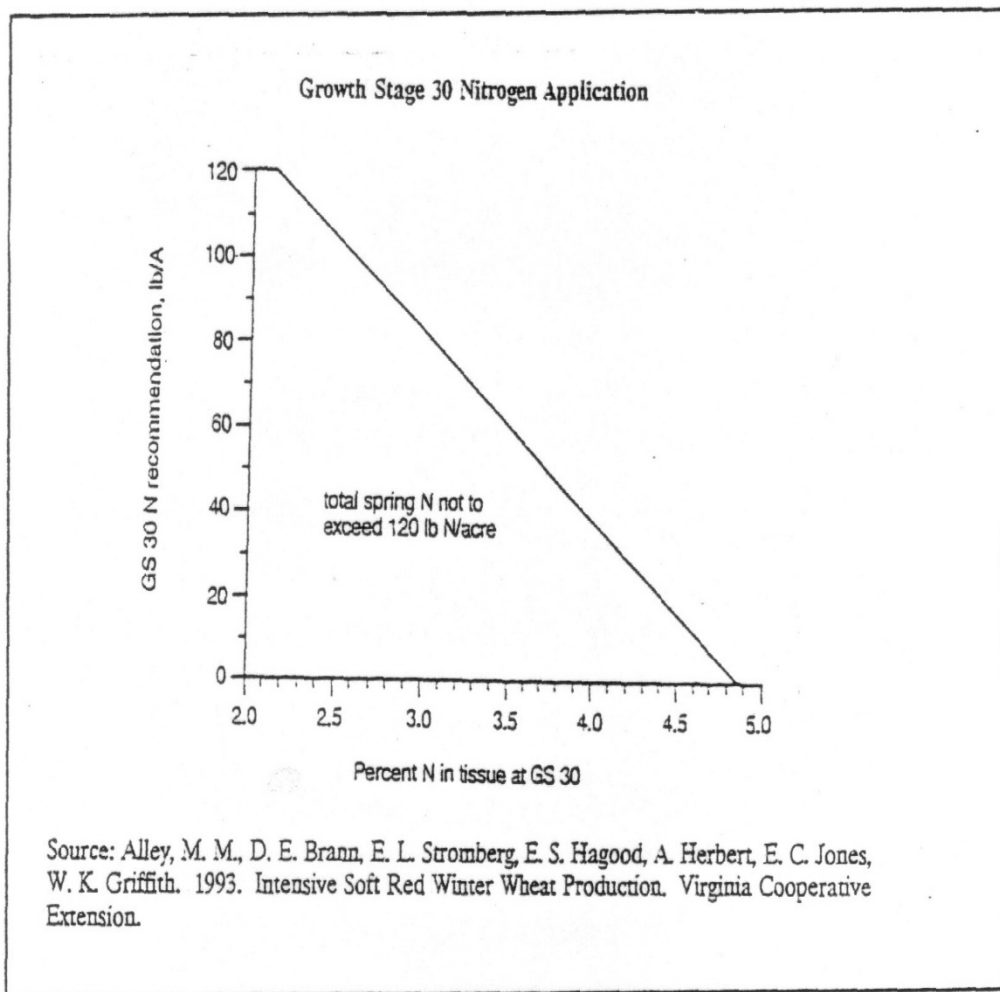


To determine the rate for the growth stage 25 application, one needs to determine the number of tillers per square foot in the field. If there are less than 60 per square foot, apply 60 pounds per acre at growth stage 25. If there are between 60 and 100 tillers, determine the rate from Figure 5-2. If there are more than 100 tillers per square foot and the crop has a dark green color, do not apply any nitrogen at this time.

(Spring N management continued on next page)

- (2) March (Zadoks growth stage 30).
- (a) N application rate for wheat based on the % N in a plant tissue sample taken at Zadoks growth stage 30 using Fig. 5-3. **NOTE:** Observations have shown that barley topdress rate should be decreased by 0.5% N.

Figure 5-3



Nitrogen Application Recommendations for Wheat and Barley (Summary)

Season	Application Criteria	N Application Program
I. Planting	Nitrate Soil Test	
	>30 ppm (top 6 inches)	None
	<30 ppm (top 6 inches)	Apply 15-30 lbs/ac. N
	None	Conventional Tillage-broadcast & incorporate to 1-2 inches, 25-30 lbs/ac N; No-Till-broadcast 25-30 lb N/acre
II. Midwinter (Dec.-January)		
Precipitation	2 or more rainfalls >2.0 inches AND	
Tiller Development	<3 tillers per plant; pale green AND	
Max. Daily Temp.	>50°F	THEN: Apply 30 lbs N/acre topdressed
III. Late Winter (Feb. - Early March)	Tiller Count:	
Single Application:	<70/sq. ft.	80 lbs/ac. N-Feb.(Growth Stage 25)
	>100; plants dark green; tissue N levels >3.75%	30-40 lbs/ac. N- late March (Zadoks Growth Stage 30)
Split Application:		
February (Zadoks Growth Stage 25)	<60/sq. ft.	60 lbs ac.N
	60-100/sq. ft.	40 lbs/ac. N
	>100/sq. ft. and dark green color	none; tissue test at growth stage 30
March (growth stage 30 tissue test)	Refer to Figure 5-3 for N rates based on tissue test	No more than 120 lbs N/acre - <u>total of Growth Stages 25 and 30</u>

Phosphorus and Potassium Nutrient Needs (Standard/Intensive Small Grain Management)

Soil Test Level

L
M
H
VH

Nutrient Needs (lbs/ac)

<u>P₂O₅</u>	<u>K₂O</u>
80 – 120	80 – 120
40 – 80	40 – 80
20 – 40	20 – 40
0	0

Canola

Nitrogen Fertilization:

1. Apply 30 - 40 lbs/ac. N at planting time. Broadcast and disc-in before planting.
2. Apply 90 - 120 lbs/ac. N in late February just before spring growth begins. For soils which are a High environmental risk for nitrogen loss, the late winter application should be split with the first 45 to 60 lbs/ac being applied in late February and the second 45 to 60 lbs/ac being applied 4 weeks later.

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>	
	<u>P₂O₅</u>	<u>K₂O</u>
L	80 -120	80 -120
M	40 - 80	40 - 80
H	20 - 40	20 - 40
VH	0	0

Peanuts

Phosphorus and Potassium Nutrient Needs:

The phosphorus and potassium nutrient needs for peanuts can be applied at the same time the crop preceding peanuts in the rotation is fertilized. If not applied at that time, it should be plowed down before peanuts are planted.

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>	
	<u>P₂O₅</u>	<u>K₂O</u>
L	100-200	80 -120
M	55 – 85	0
H	0 - 40*	0
VH	0	0

*Apply 40 lbs/ac at H-. No P₂O₅ recommended at H and H+.

Apply ½ pound of elemental boron per acre per year at early bloom stage in a compatible labeled pesticide spray or dust or as a separate foliar application. (Va. Tech Soil Test Note 4).

Cotton

Nitrogen Needs:

The planned rate of total nitrogen application should take into consideration the crop that cotton will be following and the soil on which it will be grown. The following suggestions consider both:

<u>Soil Management Groups on Which Cotton Will Be Grown</u>		<u>Total N Application</u> <u>Lbs/Acre</u>
I.	A, AA, B, C, E, J, K	50-60
II.	F, Q, R, S, T, DD, II	60-90
III.	N, O, V, X	50-70
IV.	Soil Management Groups that are not suited for cotton production: P, Z, BB, CC, EE, FF, HH, JJ, KK, LL, MM, NN, OO, PP, QQ.*	
V.	Soil Management Groups on which cotton will not be grown: D, G, H, I, J, L, M, U, W, Y, GG.	

* **"Soils in this field are not suited for cotton production. If at all possible, select another field, but if cotton will be grown, apply 50-70 lbs of N per acre."**

Reduce the planned rate of nitrogen application by 10 pounds per acre if cotton will be following soybeans and by 20 pounds per acre if it will follow peanuts.

Soil Test Level

Nutrient Needs (lbs/ac)

	<u>P₂O₅</u>	<u>K₂O</u>
L	80 – 120	80 -120
M	40 – 80	40 - 80
H	20 – 40	20 - 40
VH	0	0

Timing of Nitrogen Application on Cotton

Only about 20 percent of the total nitrogen uptake will have occurred by early square formation (approximately 45 days after planting). To avoid possible stimulation of excessive vegetative growth and loss of unneeded nitrogen through leaching, apply only one third of the planned nitrogen application rate at planting. The most effective method of application of this nitrogen is in a starter fertilizer which would also supply 20 to 40 pounds of P₂O₅ depending upon P₂O₅ needs as shown by a soil test. This can be done by using either a 1:1:0 ratio fertilizer such as 15-15-0, a 1:2:0 ratio fertilizer such as 18-46-0 or a 1:3:0 fertilizer such as 10-34-0. Use of a starter fertilizer has been shown to stimulate the early growth rate and increase lint cotton yields by 60 to 100 pounds per acre, both of which are desirable.

The preferred placement of this starter fertilizer is two inches to one side of the seed and at least as deep as the seeds are planted but preferably one to two inches below seed level. Placing the starter fertilizer in the row behind the subsoiler shank while ripping under the row has also been shown to be an effective placement. However, applying the starter fertilizer in a 3 to 4 inch wide band on the soil surface in front of the press wheel has not proven to be an effective placement method in research conducted in North Carolina.

The remainder of the planned nitrogen application can be applied at first square formation (approximately 45 days after planting).

Apply ½ pound of elemental boron per acre per year in a compatible labeled pesticide spray or dust or as a separate foliar application. (Va. Tech Soil Test Note 4).

White Potatoes - All Soil Productivity Groups

Soil Test Level	Nutrient Needs (lbs/ac)		
	N	P ₂ O ₅	K ₂ O
L	125-150*	200	300
M	125-150*	150	200
H	125-150*	100	100
VH	125-150*	30**	50

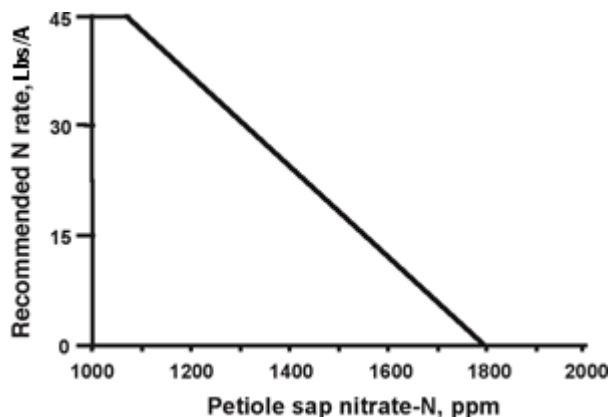
* Nitrogen recommendation for yields up to 250 cwt/acre. Split apply nitrogen with 1/3 of the rate applied at planting and remaining 2/3 to be applied 1-2 weeks after emergence.

** For phosphorus soil test levels exceeding 65% saturation as shown in Table 4-1, Section IV, or if the Phosphorus Index rating is greater than 100, no phosphorus application shall be made to the field, including starter.

When documented yields for the field (average of the high 3 yields in the last 5 years) indicate an expected yield of greater than 250 cwt/acre use .6 (six-tenths) X the expected tuber yield (cwt/ac) to determine the nitrogen recommendation. At this higher nitrogen recommendation, use a three way split as follows, 1/6 -1/3 of the total recommendation at planting, 1/2 to 2/3 of the total recommendation at emergence, and 1/6 of the total recommendation at flowering. The combination of nitrogen applications applied before flowering shall not exceed 5/6 of the total nitrogen need when using this program.

For more efficient nitrogen management application at flowering, apply the remaining nitrogen from the 3-way nitrogen split, or use the figure below showing petiole sap concentrations at flowering to adjust nitrogen application rate.

Figure 5-4 White Potato Petiole Sap Nitrate Concentration before Flowering



Note: At greater than 1500 ppm, response to additional nitrogen is unlikely.

Sudangrass, Sudan-Sorghum Hybrids and Millet Plantings

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	70*	100-120	100-120
M	70*	70-90	70-90
H	70*	40-60	40-60
VH	70*	0	0

- * The N recommendation is for application at planting. If additional pasture, hay, silage production is desired, apply 40-60 lbs/A N after each cutting, or 30-40 lbs/ac. N after each grazing. Do not apply more than 130 lbs/A N per year.

Alfalfa and Alfalfa-Orchardgrass Establishment

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>	
	<u>P₂O₅</u>	<u>K₂O</u>
L	150-170	150-170
M	120-140	120-140
H	50-110	50-110
VH	0	0

Alfalfa and Alfalfa-Grass Hay Maintenance, Soil Productivity Group I

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>	
	<u>P₂O₅</u>	<u>K₂O</u>
L	100-120	390-450*
M	70-90	300-360*
H	40-60	40-210*
VH	0	0

- * For K₂O rates greater than 200 lbs/ac, split the application, applying 1/2 in the fall and 1/2 in the spring. (Alternate recommendation where field sampled in spring - apply 1/2 in early spring, and 1/2 after the first cutting).

Apply 2 to 4 pounds of elemental boron per acre per year with a broadcast fertilizer. (Va. Tech Soil Test Note 4).

Alfalfa and Alfalfa-Grass Hay Maintenance, Soil Productivity Group II

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>	
	<u>P₂O₅</u>	<u>K₂O</u>
L	100-120	280-330*
M	70-90	220-270*
H	40-60	60-200
VH	0	0

- * For K₂O rates greater than 200 lbs/acre, split the application, applying 1/2 in the fall and 1/2 in the spring. (Alternate recommendation where field sampled in spring - apply 1/2 in early spring, and 1/2 after the first cutting).

Apply 2 to 4 pounds of elemental boron per acre per year with a broadcast fertilizer. (Va. Tech Soil Test Note 4).

Alfalfa and Alfalfa-Grass Hay Maintenance, Soil Productivity Group III, IV, V

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>	
	<u>P₂O₅</u>	<u>K₂O</u>
L	70-90	200-240*
M	40-60	160-180
H	40	40-140
VH	0	0

- * For K₂O rates greater than 200 lbs/ac, split the application, applying 1/2 in the fall and 1/2 in the spring. (Alternate recommendation where field sampled in spring - apply 1/2 in early spring, and 1/2 after the first cutting).

Apply 2 to 4 pounds of elemental boron per acre per year with a broadcast fertilizer.(Va. Tech Soil Test Note 4).

Red Clover-Orchardgrass, Orchardgrass/Fescue-Ladino Clover, Orchardgrass and Fescue Establishment

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	40*	150-170	150-170
M	40*	120-140	120-140
H	40*	40-110	40-110
VH	40*	0	0

* Apply the nitrogen at the time the grass is seeded in late summer, early fall or early spring. Overseed the grass with clover the following February.

Red Clover-Grass Hay Maintenance, Soil Productivity Groups I, II

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	0	100-120	200-240
M	0	70-90	160-180
H	0	40-60	40-140
VH	0	0	0

Red Clover-Grass Hay Maintenance, Soil Productivity Groups III, IV

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	0	70-90	120-150
M	0	40-60	80-110
H	0	40	40-70
VH	0	0	0

Stockpiled Tall Fescue, Soil Productivity Groups I, II

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	60-100*	100-120	100-120
M	60-100*	40-90	40-90
H	60-100*	0	0
VH	60-100*	0	0

- * Remove animals by early August and apply the N between August 1-15. Keep animals off pasture until November to allow stand to mature. Where clover makes up more than 25% of the stand, use the 60 lbs/ac. N rate. If clover is not present and you desire maximum production, apply the 100 lbs/ac. N rate.

Stockpiled Tall Fescue, Soil Productivity Groups III, IV, V

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	50-80*	40-60	60-80
M	50-80*	30	30-50
H	50-80*	0	0
VH	50-80*	0	0

- * Remove animals by early August and apply the N between August 1-15. Keep animals off pasture until November to allow stand to mature. Where clover makes up more than 25% of the stand, use the 50 lbs/ac. N rate. If clover is not present and you desire maximum production, apply the 80 lbs/ac. N rate.

Orchardgrass/Fescue-Clover Pastures, Soil Productivity Groups I, II

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	0*	100-120	100-120
M	0*	40-90	40-90
H	0*	0	0
VH	0*	0	0

- * If stand contains less than 25% clover, apply 50-80 lbs/ac. of N.

If additional production is needed later on, apply 40 to 60 lbs/ac. of N in late summer.

If you are planning to overseed a legume into the stand, do not apply any N.

If organic nutrient sources are utilized, up to 120 lbs/ac. of N may be applied if the application is no more frequent than once every 2 years. When applying organic nutrient sources pasture should be maintained at no less than three inches in height in order to reduce runoff and assure adequate regrowth of crop.

Orchardgrass/Fescue-Clover Pastures, Soil Productivity Groups III, IV, V

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	0*	40-60	60-80
M	0*	30	30-50
H	0*	0	0
VH	0*	0	0

- * If stand contains less than 25% clover, apply 40-60 lbs/ac. of N.

If additional production is needed later on, apply 40 to 60 lbs/ac. of N in late summer.

If you are planning to overseed a legume into the stand, do not apply any N.

If organic nutrient sources are utilized, up to 100 lbs of N may be applied if the application is no more frequent than once every 2 years. When applying organic nutrient sources, pasture should be maintained at no less than three inches in height in order to reduce runoff and assure adequate regrowth of crop.

Native or Unimproved Pastures, Soil Productivity Groups I, II

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	0*	150-200	150-200
M	0*	75-125	75-125
H	0*	0	0
VH	0*	0	0

- * If stand contains less than 25% clover, apply 40-60 lbs/ac. of N.

For phosphorus and potassium - apply once every three or four years.

If you are planning to overseed a legume into the stand, omit the N application.

When applying organic nutrient sources, pasture should be maintained at no less than three inches in height in order to reduce runoff and assure adequate regrowth of crop.

Native or Unimproved Pastures, Soil Productivity Groups III, IV

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	0*	100-120	100-120
M	0*	40-90	40-90
H	0*	0	0
VH	0*	0	0

- * If stand contains less than 25% clover, apply 40-60 lbs/ac. N.

When applying organic nutrient sources, pasture should be maintained at no less than three inches in height in order to reduce runoff and assure adequate regrowth of crop.

For phosphorus and potassium - apply once every three or four years.

Orchardgrass/Fescue (Tall Grass) Hay Production, Soil Productivity Groups I, II

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	80-100*	100-120	200-240
M	80-100*	70-90	160-180
H	80-100*	40-60	40-140
VH	80-100*	0	0

- * The N recommendation is for a March application of commercial fertilizer.

If additional hay production is needed, apply 80 lbs/ac N after each cutting during the growing season. Use the number of cuttings to determine total nitrogen rate with a maximum annual rate not to exceed 250 lbs/acre per year.

Organic nutrient sources may be applied in one or more applications, not to exceed 250 lbs/acre plant available nitrogen annually. If applied after 9/1 of any year until 3/1 of the following year, application rates during this period shall not exceed ½ of the total nitrogen rate (125 lbs/acre).

When applying organic nutrient sources, fields should be maintained at no less than three inches in height in order to reduce runoff and assure adequate regrowth of crop.

Orchardgrass/Fescue (Tall Grass) Hay Production, Soil Productivity Groups III, IV

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	60-80*	70-90	120-150
M	60-80*	40-60	80-110
H	60-80*	40	40-70
VH	60-80*	0	0

- * N recommendation is for a March application of commercial fertilizer.

For additional fall hay production apply 60-80 lbs N/acre in late August/early September. Do not apply more than 160 lbs N/acre/year.

Organic nutrient sources may be applied in one or more applications, not to exceed 160 lbs/acre plant available nitrogen annually. If applied after 9/1 of any year until 3/1 of the following year, application rates during this period shall not exceed ½ of the total nitrogen rate (80 lbs/acre).

When applying organic nutrient sources, fields should be maintained at no less than three inches in height in order to reduce runoff and assure adequate regrowth of crop.

Bermudagrass Establishment

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	70	100-120	100-120
M	70	70-90	70-90
H	70	40-60	40-60
VH	70	0	0

Bermudagrass Pastures - Soil Productivity Groups I, II

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	175-225*	100-120	100-120
M	175-225*	40-90	40-90
H	175-225*	0	0
VH	175-225*	0	0

- * The N recommendation represents the total amount of Nitrogen to be applied during the season. Split the N into three applications - April, June and July.

Organic nutrient sources may be applied in one or more applications, not to exceed 225 lbs./ac. plant available nitrogen annually. If applied after 7/1, application rates shall not exceed ½ the total nitrogen rate (112 lbs/ac.) based on above criteria while crop is still actively growing up to 9/15, with the remaining rate not to be applied until after 4/1 of the following year.

When applying organic nutrient sources, pastures should be maintained at no less than three inches in height in order to reduce runoff and assure adequate regrowth of crop.

Bermudagrass Pastures - Soil Productivity Groups III, IV, V**

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	120-180*	100-120	100-120
M	120-180*	40-90	40-90
H	120-180*	0	0
VH	120-180*	0	0

- * The N recommendation represents the total amount of N to be applied during the season. Split the N into three applications - April, June and July.

- ** Use the lower end of range for Group V soils.

Organic nutrient sources may be applied in one or more applications, not to exceed 180 lbs/ac. plant available nitrogen annually. If applied after 7/1 application rates shall not exceed ½ the total nitrogen rate (90 lbs/ac.) based on above criteria while crop is still actively growing up to 9/15, with the remaining rate not to be applied until after 4/1 of the following year.

When applying organic nutrient sources, pastures should be maintained at no less than three inches in height in order to reduce runoff and assure adequate regrowth of crop.

**Bermudagrass Hay Production, Soil Productivity Groups I, II
(Use Tall Grass Productivity Group)**

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	240-300*	100-120	235-275
M	240-300*	70-90	185-225
H	240-300*	40-60	40-165
VH	240-300*	0	0

- * Total application of N should be divided equally between an early April application and applications made after the first and second harvests.

Organic nutrient sources may be applied in one or more applications, not to exceed 300 lbs/ac. plant available nitrogen annually. If applied after 7/1, application rates shall not exceed ½ the total nitrogen rate (150 lbs/ac.) based on above criteria while crop is still actively growing up to 9/15, with the remaining rate not to be applied until after 4/1 of the following year.

When applying organic nutrient sources, fields should be maintained at no less than three inches in height in order to reduce runoff and assure adequate regrowth of crop.

Bermudagrass Hay Production, Soil Productivity Groups III, IV, V
(Use Tall Grass Productivity Group)**

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	210-260*	100-120	235-275
M	210-260*	70-90	185-225
H	210-260*	40-60	40-165
VH	210-260*	0	0

- * Total application of N should be divided equally between an early April application and applications made after the first and second harvests.

- ** Use the lower end of range for Group V soils.

Organic nutrient sources may be applied in one or more applications, not to exceed 260 lbs/ac. plant available nitrogen annually. If applied after 7/1 application rates shall not exceed ½ the total nitrogen rate (130 lbs/ac.) based on above criteria while crop is still actively growing up to 9/15, with the remaining rate not to be applied until after 4/1 of the following year.

When applying organic nutrient sources fields should be maintained at no less than three inches in height in order to reduce runoff and assure adequate regrowth of crop.

**Annual Ryegrass Hay Production, Soil Productivity Groups I and II
(Use Tall Grass Productivity Group)**

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	40-50*	100-120	200-240
M	40-50*	70-90	160-180
H	40-50*	40-60	40-140
VH	40-50*	0	0

- * The above N rates are recommended at seeding during the Fall. For additional production 30-40 lbs/ac of N should be added after each grazing, not to exceed 160 lbs/ac. annually. For hay production 40-60 lbs/ac N after each cutting, not to exceed 200 lbs/ac. annually.

When applying organic nutrient sources, fields should be maintained at no less than three inches in height in order to reduce runoff and assure adequate regrowth of crop.

**Annual Ryegrass Hay Production, Soil Productivity Groups III and IV
(Use Tall Grass Productivity Group)**

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	40-50*	70-90	120-150
M	40-50*	40-60	80-110
H	40-50*	40	40-70
VH	40-50*	0	0

- * The above N rates are recommended at seeding during the Fall. For additional production, 30-40 lbs/ac of N should be added after each grazing, not to exceed 140 lbs/ac annually. For hay production, 40-60 lbs/ac N after each cutting, not to exceed 180 lbs/ac annually.

When applying organic nutrient sources, fields should be maintained at no less than three inches in height in order to reduce runoff and assure adequate regrowth of crop.

**Prairie Grass (Matua) Hay Production, Soil Productivity Groups I and II
(Use Tall Grass Productivity Group)**

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	80-100*	100-120	280-330
M	80-100*	70-90	220-270
H	80-100*	40-60	60-200
VH	80-100*	0	0

- * The N recommendation is for a March application. Apply 40-60 lbs/ac after hay or silage cutting. Do not exceed 300 lbs/ac per year for hay. When pastured after hay harvest, apply 30-40 lbs/ac after each grazing. Do not exceed 200 lbs/ac per year for intensive rotational grazing.

When applying organic nutrient sources, fields should be maintained at no less than three inches in height in order to reduce runoff and assure adequate regrowth of crop.

**Prairie Grass (Matua) Hay Production, Soil Productivity Groups III and IV
(Use Tall Grass Productivity Group)**

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	60-80*	100-120	200-240
M	60-80*	70-90	160-180
H	60-80*	40-60	40-140
VH	60-80*	0	0

- * The N recommendation is for a March application. Apply 40-60 lbs/A after hay or silage cutting. Do not exceed 250 lbs/A per year for hay. When pastured after hay harvest, apply 30-40 lbs/ac after each grazing. Do not exceed 180 lbs/ac per year for intensive rotational grazing.

When applying organic nutrient sources, fields should be maintained at no less than three inches in height in order to reduce runoff and assure adequate regrowth of crop.

Switchgrass - All Soil Productivity Groups

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N*</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	40-60	100-120	100-120
M	40-60	40-90	40-90
H	40-60	0	0
VH	40-60	0	0

*If stand contains greater than 25% legumes, no Nitrogen is required.

For establishment no Nitrogen is needed, follow P₂O₅ and K₂O soil test recommendations shown above.

When applying organic nutrient sources, fields should be maintained at no less than three inches in height in order to reduce runoff and assure adequate regrowth of crop.

Caucasian Bluestem (hay or pasture), All Soil Productivity Groups

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	60-120*	100-120	100-120
M	60-120*	40-90	40-90
H	60-120*	0	0
VH	60-120*	0	0

*This is an annual nitrogen rate. Annual nitrogen rate should be applied in split applications, such as between grazings or cuttings if used for hay.

If organic nutrient sources are utilized, up to 120 lbs of N may be applied if the application is no more frequent than once every 2 years.

When applying organic nutrient sources, fields should be maintained at no less than three inches in height in order to reduce runoff and assure adequate regrowth of crop.

Tobacco Recommendations:

Flue-Cured

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	N	P ₂ O ₅	K ₂ O
L	60-70	290-330	150-175
M		60-100	100-150
H		40	100
VH		40*	100

* For phosphorus soil test levels exceeding 65% saturation as shown in Table 4-1, Section IV, or if the Phosphorus Index is greater than 100, no phosphorus application shall be made to the field, including starter.

- 50% of the total nitrogen need should be in the nitrate nitrogen form.
- Pre-plant broadcast fertilizer should not exceed 40 lbs/ac of nitrogen and 120 lbs/ac. of potash. Balance of nutrient recommendation can be applied as a sidedress application.
- Use of soluble fertilizer in transplant water is discouraged where soil test levels are M+ and higher. For phosphorus soil test levels Medium or below, soluble fertilizer may be used. Select a product approved for direct application in the row with the plant. Total phosphorus applied can not exceed phosphorus nutrient need.
- Potassium source should not contain any chloride compounds.

Dark-Fired

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	N	P ₂ O ₅	K ₂ O
L	135	290-330	150-175
M		60-100	100-150
H		40	100
VH		40*	100

* For phosphorus soil test levels exceeding 65% saturation as shown in Table 4-1, Section IV, or if the Phosphorus Index is greater than 100, no phosphorus application shall be made to the field, including starter.

- 50% of the total nitrogen need should be in the nitrate nitrogen form.
- Pre-plant broadcast fertilizer should not exceed 60-70 lbs/ac. of nitrogen and 120 lbs/ac. of potash. Balance of nutrient recommendation can be applied as a sidedress application.
- Use of soluble fertilizer in transplant water is discouraged where soil test levels are M+ and higher. For phosphorus soil test levels Medium or below, soluble fertilizer may be used. Select a product approved for direct application in the row with the plant. Total phosphorus applied can not exceed phosphorus nutrient need.
- Potassium source should not contain any chloride compounds.

Burley

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	N	P ₂ O ₅	K ₂ O

L		290-330	250-350
M	175 - 200	60-100	200-250
H		40	100-200
VH		40*	100

* For phosphorus soil test levels exceeding 65% saturation as shown in Table 4-1, Section IV, or if the Phosphorus Index is greater than 100, no phosphorus application shall be made to the field, including starter.

- 50% of the total nitrogen need should be in the nitrate nitrogen form.
- Pre-plant broadcast fertilizer should not exceed 100 lbs/ac. of nitrogen and 120 lbs/ac. of potash. Balance of nutrient recommendation can be applied as a sidedress application.
- Use of soluble fertilizer in transplant water is discouraged where soil test levels are M+ and higher. For phosphorus soil test levels Medium or below, soluble fertilizer may be used. Select a product approved for direct application in the row with the plant. Total phosphorus applied can not exceed phosphorus nutrient need.
- Potassium source should not contain any chloride compounds.

Hardwood and Pine Nutrient Application Rates and Timing

All references to age of trees or stands starts as of the time the trees were planted at the site and not the age of the seedling tree at planting.

Hardwood and Pine Plantation Establishment (0 - 3 years of age) - All Soil Productivity Groups

<u>Soil Test Level</u>	<u>Nutrient Needs, (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
L	0	50-70	50-80
M	0	10-40	10-40
H	0	0	0
VH	0	0	0

- Phosphorus and potassium may be applied by incorporation before planting, or by broadcast on the soil surface or by banding along the planting row.
- Acceptable pH ranges for pines are pH 4.5 to 6 and should not exceed pH 6.5. Acceptable pH ranges for hardwoods are pH 5 to 7 and should not exceed pH 7.5. If the soil pH falls within these ranges, it is not necessary to apply lime.
- Control of competing vegetation, including both woody and herbaceous species, may be required within the stand following planting to avoid overtopping of the seedlings and thus decrease tree survival.

Pine* and Hardwood Maintenance (3 to 10 years of age) – All Soil Productivity Groups

<u>Soil Test Level</u>	<u>Nutrient Needs, (lbs/ac)</u>		
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>
	See detailed nitrogen management below		
L		50-70	50-80
M		10-40	10-40
H		0	0
VH		0	0

*Pines Species includes loblolly, short leaf, Virginia, and white pine.
Long leaf pine should not exceed 100 lbs/ac N at any age.

Nitrogen intervals and rates for Pine and Hardwood Maintenance

- **Between ages 3-10**, one application of N at a rate of 50 to 100 lbs/acre can be made to the stand. Applications in pines at this stage of growth shall be made no sooner than one month before the average date of the last killing frost in the Spring (Fig. 6-2, Section VI) and ending no later than two months before the average date of the first killing frost in the Fall. (Fig 6-1, Section VI).
- **After age 10**, applications of nitrogen can be made using one of the nitrogen rates and application intervals listed in the table below. The applications can continue at the selected interval and rate until approximately 5 years before expected harvest of the trees.

Interval between Nitrogen applications	Nitrogen Application Rate (lbs/ac)per Application Interval ^a
4-6 yrs.	100
OR	
6-8 yrs.	150
OR	
8-10 yrs.	200

^a - Long leaf pine may receive no more than 100 lbs/ac of nitrogen after age >10 years, every 4-6 years.

Season of Nitrogen Application

- No applications shall be made when the soil is saturated or standing water is present on the surface of the soil, regardless of the time of year.
- Pine: Applications in pine stands greater than 10 years of age may be made at any time of the year that the soil is not saturated or standing water is not present on the soil surface.
- Hardwood: Applications in hardwoods shall be limited to the growing season. Applications in hardwood forests shall be made no sooner than one month before the average date of the last killing frost in the Spring (Fig. 6-2, Section VI) and ending no later than two months before the average date of the first killing frost in the Fall. (Fig 6-1, Section VI).

Understory vegetation

Moderate amounts of understory vegetation that is below the canopy of the planted trees is acceptable in mid-rotation stands. This vegetation will take up nutrients and reduce runoff. However, if understory vegetation is excessive, that is, it is as tall or taller than the planted trees, suppression of the understory vegetation may be needed. Consult a local Virginia Department of Forestry forester to develop an understory management program.

- In all cases Best Management Practices for nutrient applications, such as adhering to buffers for wells and surface waters is required.

Christmas Trees - Establishment (broadcast before planting)
White Pine, Virginia Pine, Scotch Pine

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	N	P₂O₅	K₂O
L	100-120	90-150	100-160
M	100-120	40-80	50-90
H	100-120	30	40
VH	100-120	0	0

Christmas Trees – Establishment (broadcast before planting)
Fraser Fir, Norway Spruce, Hemlock, Blue Spruce, Red Cedar

<u>Soil Test Level</u>	<u>Nutrient Needs (lbs/ac)</u>		
	N	P₂O₅	K₂O
L	100-120	160-300	150-250
M	100-120	60-150	60-150
H	100-120	30-50	30-50
VH	100-120	0	0

Christmas Trees – Maintenance

- A nitrogen application of 50-60 lbs/acre should be made with the first Spring application to be made about 2 weeks before budbreak. A Fall application of 50-60 lbs/acre can be made anytime beginning in September, but no later than the end of October.
- Use the Fertilizer Recommendations table under **Establishment** for the appropriate rate for the specific species. Base P₂O₅ and K₂O applications on soil test results taken before planned maintenance applications.
- Maintenance fertilizer applications should be uniformly applied in 2 to 3 foot wide bands between the trees along the planted row.

OR

- For a rate per tree, determine the fertilizer rate in ounces (lbs/ac X 16) then divide by the number of trees per acre. (100 lbs/ac of N X 16 ozs/lb = 1600 ozs. Then 1600 ozs ÷ no. of trees/ac = ozs/tree).

Description:

Nutrient recommendations for fields that have a hay/pasture rotation. The hay crop is mechanically harvested at least once which should be in spring and the harvested crop must be removed from the field and utilized for a suitable purpose, and followed by pasturing of livestock at the recommended stocking rate for the predominant soil productivity group in the field.

Procedure:

The following tables are to be used to determine the annual agronomic rate for fields that meet the above criteria of hay/pasture.

**Hay/Pasture,
Soil Productivity Groups I, II**

Soil Test Level	Fertilizer Recommendations, Lb/A		
	N	P ₂ O ₅	K ₂ O
L-	120	120	200
L	120	110	180
L+	120	100	160
M-	120	90	140
M	120	80	120
M+	120	70	100
H-	120	60	80
H	120	50	60
H+	120	40	40
VH	120	0	0

**Hay/Pasture,
Soil Productivity Groups III, IV**

Soil Test Level	Fertilizer Recommendations, Lb/A		
	N	P ₂ O ₅	K ₂ O
L-	100	90	120
L	100	80	110
L+	100	70	100
M-	100	60	90
M	100	50	80
M+	100	40	70
H-	100	30	60
H	100	20	50
H+	100	0	40
VH	100	0	0

If the recommendations in the nutrient management plan are being written using phosphorus crop removal rates. The phosphorus application rate shall not exceed the greater of crop nutrient needs or the crop nutrient removal. Annual nitrogen crop need shall not exceed the recommended rate for that soil

productivity group.

Hay/ Pasture P ₂ O ₅ Removal	
Soil Productivity Group	P ₂ O ₅
I	55
II	45
III	30
IV	30

The following examples are for nutrient management plans developed using phosphorus removal or needs rates.

Example 1

Hay/pasture field with a soil productivity group II. Soil test M for P₂O₅ and K₂O.

The annual crop nutrient recommendations are as follows:

	<u>Lb/A</u>
Nitrogen	120
P ₂ O ₅	80
K ₂ O	120

Example 2

Hay/pasture field with a soil productivity group III Soil test VH for P₂O₅ and M- for K₂O

The annual crop nutrient recommendations are as follows:

	<u>Lb/A</u>
Nitrogen	100
P ₂ O ₅	0
K ₂ O	90

Commonwealth of Virginia

Virginia Nutrient Management Agriculture Crop Needs Technical Document Revised **TBD**

Department of Conservation and Recreation
Division of Soil and Water Conservation
600 East Main Street, 4th floor
Richmond, VA 23219

**DRAFT TO BE NAMED TECHNICAL DOCUMENT
Turf Crop Nutrient Needs**

Insert TOC Listing Each Crop

Reformat to have the following groupings (as they're in no order now)

Insert Information about Using OUTSIDE, but DCR APPROVED, resources

Copied from page 60 of S&C 2014 Phosphorus and potash soil test levels in this table are based on Mehlich I soil test results. Only soil test levels correlated to Mehlich I using methods contained in this document are acceptable.

The following is copied directly from the S&C 2014 edition. Please add edits created by Gonzalo Ortiz and Justin Lindemeyer to the following pages.

Definitions

For the purposes of this section, the following definitions, as presented by the Association of American Plant Food Control Officials (AAPFCO), apply:

“Enhanced efficiency fertilizer” describes fertilizer products with characteristics that allow increased plant nutrient availability and reduce the potential of nutrient losses to the environment when compared to an appropriate reference product.

“Slow or controlled release fertilizer” means a fertilizer containing a plant nutrient in a form which delays its availability for plant uptake and use after application, or which extends its availability to the plant significantly longer than a reference “rapidly available nutrient fertilizer” such as ammonium nitrate, urea, ammonium phosphate or potassium chloride. A slow or controlled release fertilizer must contain a minimum of 15 percent slowly available forms of nitrogen.

“Water soluble nitrogen”, “WSN” and “readily available nitrogen” means: Water soluble nitrogen in either ammonical, urea, or nitrate form that does not have a controlled release, or slow response.

Recommended Season of Application For Nitrogen Fertilizers - Applies to all Turf

A nitrogen fertilization schedule weighted toward fall application is recommended and preferred for agronomic quality and persistence of cool season turfgrass; however, the acceptable window of applications is much wider than this for nutrient management. The nutrient management recommended application season for nitrogen fertilizers to cool season turfgrasses begins six weeks prior to the last spring average killing frost date and ends six weeks past the first fall average killing frost date (see Figures 6-1 & 6-2). Applications of nitrogen during the intervening late fall and winter period should be avoided due to higher potential leaching or runoff risk, but where necessary, apply no more than 0.5 pounds per 1,000 ft² of water soluble nitrogen within a 30 day period. Higher application rates may be used during this late fall and winter period by using materials containing slowly available sources of nitrogen, if the water soluble nitrogen contained in the fertilizer does not exceed the recommended maximum of 0.5 pounds per 1,000 ft² rate. Do not apply nitrogen or phosphorus fertilizers when the ground is frozen.

The acceptable nitrogen fertilizer application season for non-overseeded warm season turfgrass begins no earlier than the last spring average killing frost date and ends no later than one month prior to the first fall average killing frost date (see Figures 6-1 & 6-2).

Figure 6-1

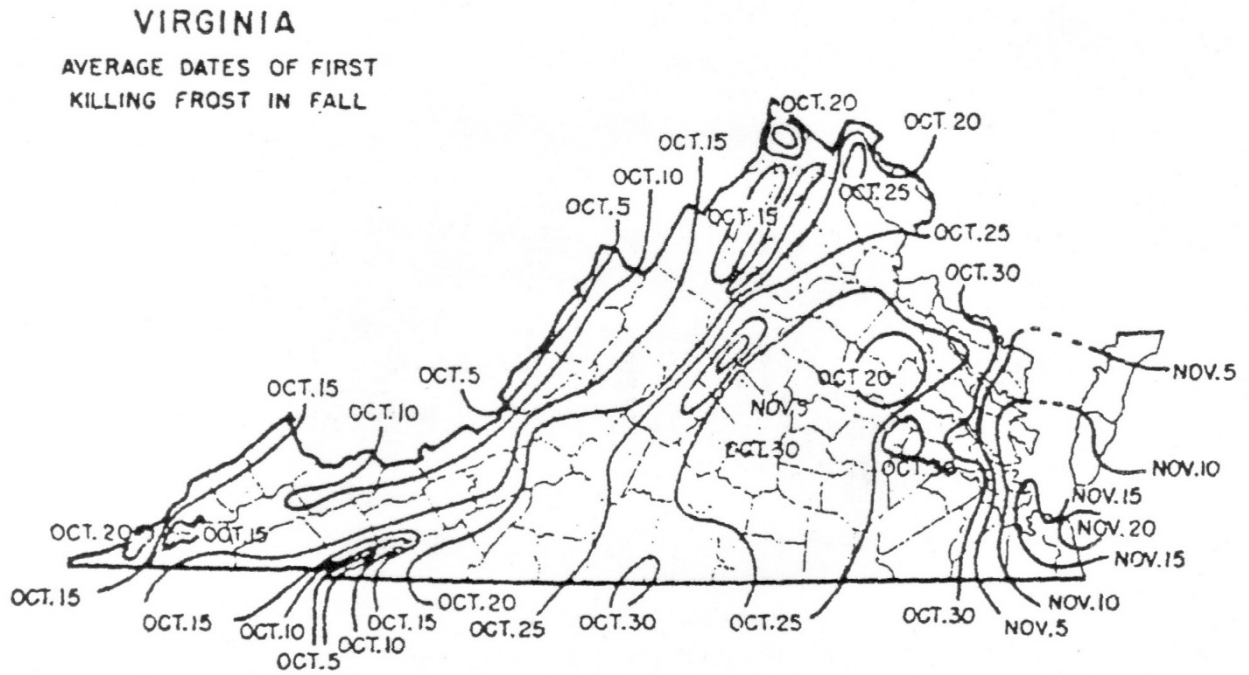
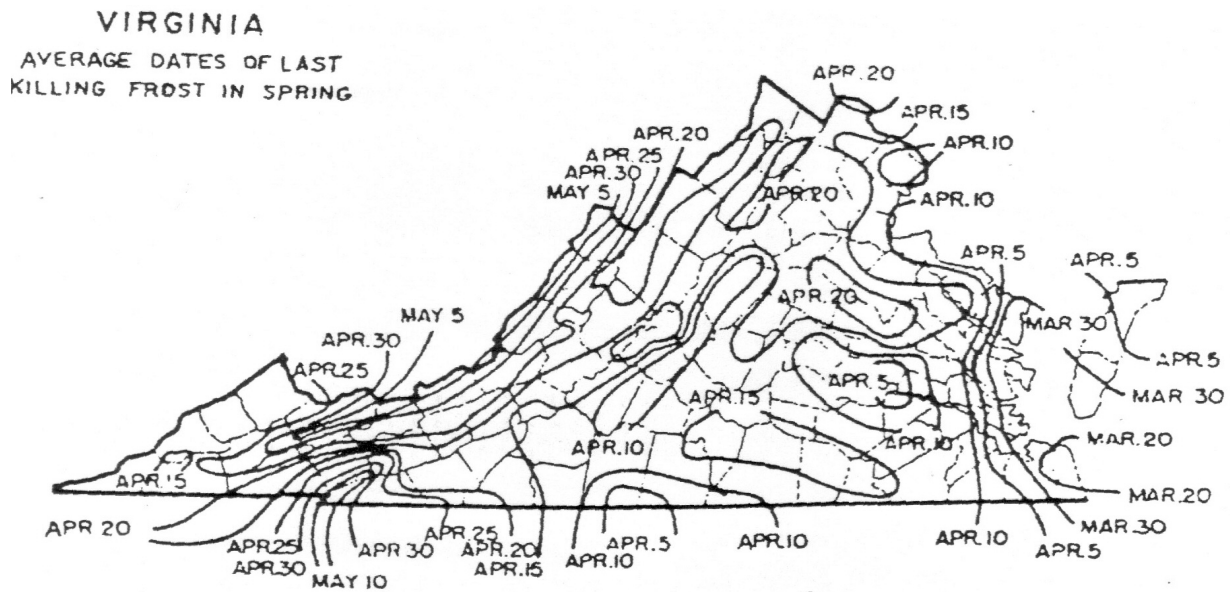


Figure 6-2



Per Application Rates

Do not apply more than 0.7 pounds of water soluble nitrogen per 1,000 ft² within a 30 day period. For cool season grasses, do not apply more than 0.9 pounds of total nitrogen per 1,000 ft² within a 30 day period. For warm season grasses, do not apply more than 1.0 pounds of total nitrogen per 1,000 ft² within a 30 day period. Lower per application rates of water soluble nitrogen sources or use of slowly available nitrogen sources should be utilized on very permeable sandy soils, shallow soils over fractured bedrock, or areas near water wells.

Annual Application Rates for Home Lawns and Commercial Turf

Up to 3.5 pounds per 1,000 ft² of nitrogen may be applied annually to cool season grass species or up to 4 pounds per 1,000 ft² may be applied annually to warm season grass species using 100 percent water soluble nitrogen sources. Lower rates of nitrogen application may be desirable on those mature stands of grasses that require less nitrogen for long-term quality. As a result, lower application rates will probably be more suited to the fine leaf fescues (hard fescue, chewings fescue, creeping red fescue, and sheep fescue) and non-overseeded zoysiagrass. Lower rates should also be used on less intensively managed areas.

Use of Slowly Available Forms of Nitrogen

For slow or controlled release fertilizer sources, or enhanced efficiency fertilizer sources, no more than 0.9 pounds of nitrogen per 1,000 ft² may be applied to cool season grasses within a 30 day period and no more than 1.0 pounds of nitrogen per 1,000 ft² may be applied to warm season grasses within a 30 day period.

Provided the fertilizer label guarantees that the product can be used in such a way that it will not release more than 0.7 pounds of nitrogen per 1,000 ft² in a 30 day period, no more than 2.5 pounds of nitrogen per 1,000 ft² may be applied in a single application. Additionally, total annual applications shall not exceed 80 percent of the annual nitrogen rates for cool or warm season grasses.

Phosphorus and Potassium Nutrient Needs (Established Turf)

Apply phosphorus (P₂O₅) and potassium (K₂O) fertilizers as indicated necessary by a soil test using the following guidelines:

<u>Soil Test Level</u>	<u>Nutrient Needs (pounds per</u>	
	<u>1000 ft²) *</u>	
	<u>P₂O₅</u>	<u>K₂O</u>
L	2-3	2-3
M	1-2	1-2
H	0.5-1	0.5-1
VH	0	0

- * For the lower soil test level within a rating, use the higher side of the range and for higher soil test level within a rating use the lower side of the recommendation range. (For example the recommendation for a P₂O₅ soil test level of L- would be 3 pounds per 1,000 ft².)

Do not use high phosphorus ratio fertilizers such as 10-10-10 or 5-10-10, unless soil tests indicate phosphorus availability below the M+ level.

Recommendations for Establishment of Turf

These recommendations are for timely planted turfgrass, that is, the seed or vegetative material (sod, plugs, and /or sprigs), are planted at a time of the year when temperatures and moisture are adequate to maximize turfgrass establishment. These recommended establishment periods would be late summer to early fall for cool-season turfgrasses and late spring through mid-summer for warm-season turfgrasses.

Nitrogen Applications

At the time of establishment, apply no more than 0.9 pounds per 1,000 ft² of total nitrogen for cool season grasses or 1.0 pounds per 1,000 ft² of total nitrogen for warm season grasses, using a material containing slowly available forms of nitrogen, followed by one or two applications beginning 30 days after planting, not to exceed a total of 1.8 pounds per 1,000 ft² total for cool season grasses and 2.0 pounds per 1,000 ft² for warm season grasses for the establishment period. Applications of WSN cannot exceed more than 0.7 pounds per 1,000 ft² within a 30 day period.

Phosphorus and Potassium Recommendations for Establishment

<u>Soil Test Level</u>	<u>Nutrient Needs (pounds per</u>	
	<u>1000 ft²) *</u>	
	<u>P₂O₅</u>	<u>K₂O</u>
L	3-4	2-3
M	2-3	1-2
H	2-1	0.5-1
VH	0	0

- * For the lower soil test level within a rating, use the higher side of the range and for higher soil test level within a rating use the lower side of the recommendation range.

Nutrient Recommendations for Golf Courses

Nitrogen Timing

The beginning and ending dates for application of nitrogen shall be determined using guidance and frost date maps contained in the Season of Application for Nitrogen section, Figures 6-1 and 6-2.

If the full rate or the highest rate of the recommendation range for a monthly application is applied in a single application, then the interval of application for nitrogen shall be at least 30 days to allow turf to utilize previous nitrogen applications. If several applications are to be made for the monthly nitrogen rate, then the timing of the applications shall be at approximately even intervals, with the rate per application to be evenly divided between each application with the total nitrogen applied not to exceed the maximum monthly rate. Use of Water Insoluble Nitrogen forms of Nitrogen is encouraged.

Nitrogen Rates

	Grass Type	Maximum WSN Rate Per Application pounds per 1,000 ft ²	Total Annual N Rate pounds per 1,000 ft ² ^a
Greens		0.7 ^(b)	3-6
Tees		0.7 ^(b)	2-5
Fairways	Cool Season	0.7 ^(c)	2-3
	Warm Season	0.7 ^(c)	3-4
Fairways - Intensive Management	Cool Season	0.5 ^(d)	3-4
	Warm Season	0.5 ^(d)	3.5-4.5
Overseeding Warm Season Fairways		0.5	1.25
Roughs		0.7 ^(e)	1-3

Fairways-Overseeding Warm Season Fairways

- For warm season grasses, up to 0.7 pounds of nitrogen per 1,000 ft² in a 30 day period may be applied in the Fall after perennial ryegrass overseeding is well established. An additional nitrogen application of 0.7 pounds per 1,000 ft² may be made in February-March to overseeded perennial ryegrass if growth and color indicate need. Applications using WSN may not exceed 0.7 pounds per 1,000 ft² within a 30 day period.
- Soluble nitrogen rates of 0.25 pounds per 1,000 ft² or less which may be a component of a pesticide or minor element application, may be applied any time during the application windows described in Recommended Season of Application for Nitrogen Fertilizers of this section, but must be considered with the total annual nitrogen application rate.

(a) Use higher rates for intensively used turf where accelerated growth and/or rapid recovery are required, use lower rates for maintenance of lesser used areas; do not exceed total annual nitrogen levels as stated above.

- (b) Greens and Tees - Per application timing must be a minimum of 30 days between applications. A rate of 0.9 pounds per 1,000 ft² of total nitrogen may be applied for cool season grasses or 1.0 pounds per 1,000 ft² of total nitrogen may be applied for warm season grasses using a material containing slowly available forms of nitrogen.
- (c) Fairways-Normal Management (Non-Irrigated or Irrigated) - Per Application timing must be a minimum of 30 days between applications. Total nitrogen application rates of 0.9 pounds per 1,000 ft² of total nitrogen may be applied for cool season grasses or 1.0 pound per 1,000 ft² of total nitrogen may be applied for warm season grasses using a material containing slowly available forms of nitrogen.
- (d) Fairways-Intensive Management (Irrigated) - Per Application timing must be a minimum of 15 days between applications. This option requires optimized timing of more frequent applications of nitrogen with lesser rates per application. Alternatively, a maximum application rate of 0.9 pounds per 1,000 ft² of total nitrogen for cool season grasses or 1.0 pounds per 1,000 ft² of total nitrogen for warm season grasses using a material containing slowly available forms of nitrogen may be applied with a minimum of 30 days between applications.
- (e) Foliar fertilizer may be applied to warm season grasses within 30 days prior to the first killing frost in the fall, at a rate not to exceed 0.1 pounds per 1,000 ft² of nitrogen per application. This application must be accounted for in the total annual nitrogen rate.

Phosphorus and Potassium Recommendations for Established Golf Courses

Apply phosphorus (P₂O₅) and potassium (K₂O) fertilizers as indicated by a soil test using the following guidelines:

<u>Soil Test Level</u>	<u>Nutrient Needs (pounds per 1000 ft²)*</u>	
	<u>P₂O₅</u>	<u>K₂O</u>
L	2-3	2-3
M	1-2	1-2
H	0.5-1	0.5-1
VH	0	0

- * For the lower soil test level within a rating, use the higher side of the range and for higher soil test level within a rating use the lower side of the recommendation range.
- For irrigated turf grown on Naturally Occurring and Modified Sand Based soils only, up to 0.5 pounds of P₂O₅ per 1,000 ft² may be applied, if needed, to aid in recovery of damaged turf during times of extreme use. No phosphorus applications shall be made when the soil phosphorus test level is above 65% saturation, based on the soil test phosphorus values and region as listed in Table 4-1 of Section IV.
- Avoid the general use of high phosphorus ratio fertilizers such as 10-10-10 or 5-10-10, unless soil tests indicate phosphorus availability below the M+ level.

Nitrogen Management on Athletic Fields - Cool Season Grasses

- This program is intended for those fields which are under heavy use.
- Nitrogen recommendations are based on the assumption that there is adequate soil moisture to promote good turf growth at the time of application. If no rainfall has occurred since the last application, further applications should be delayed until significant soil moisture is available.

Cool Season Grasses	Maintenance Program ^a	
	Normal	Intensive
When to Apply ^b	Pounds per 1,000 ft ² Nitrogen	
After August 15	-----	0.5
September	0.7	0.7 ^(c)
October	0.7 ^(c)	0.7 ^(c)
November	0.5	0.7 ^(c)
April 15 - May 15	0.5	0.5
June 1 - June 15	----	0.5

Notes:

- Soluble nitrogen rates of 0.25 pounds per 1,000 ft² or less which may be a component of a pesticide or minor element application may be applied any time the turf is actively growing, but must be considered with the total annual N application rate.
- WSN = water soluble nitrogen; WIN = water insoluble nitrogen

(a) Intensive managed areas must be irrigated.

(b) The beginning and ending dates for application of nitrogen shall be determined using guidance and frost date maps contained in the preceding Season of Application for Nitrogen section, using Figures 6-1 and 6-2.

(c) Rates up to 0.9 pounds per 1,000 ft² of total nitrogen can be applied using a material containing slowly available forms of nitrogen, with a minimum of 30 days between applications.

(d) Make this application only if turf use warrants additional N for sustaining desirable growth and /or color.

Nitrogen Management on Athletic Fields - Warm Season Grasses

The following comments apply to both Naturally Occurring or Modified Sand based Fields and Predominantly Silt/Clay Soil Fields:

- Annual nitrogen rates for warm season grasses shall not exceed **4 pounds** in areas which have the average first killing frost on or before October 20, and shall not exceed **5 pounds** in areas which have the average first killing frost after October 20 as shown in Figure 6-1. Nitrogen rates and timings for overseeding warm season grasses are not included in these rates.
- April 15 - May 15 applications should not be made until after complete green-up of turf.
- Nitrogen applications June through August should be coordinated with anticipated rainfall if irrigation is not available.
- Use the lower end of the ranges for non-irrigated fields and the higher end of the ranges should be used on fields with irrigation.
- Nitrogen rates towards the higher end of the ranges may be applied on heavily used fields to accelerate recovery, however per application and annual rates cannot be exceeded.

Bermudagrass - Predominantly Silt/Clay Soil Fields ^a		
When to Apply^b	Pounds per 1,000 ft² Nitrogen	First Fall Killing Frost Date^b
April 15 - May 15	0.5 - 0.7 ^(c)	Before Oct. 20
June	0.7	
July	0.5 - 0.7 ^(d)	
August	0.5 - 0.7 ^(d)	
Sept 1 - Sept 15	0.5 - 0.7 ^(c)	After Oct. 20
If overseeded with perennial ryegrass		
Oct - Nov	0.5 ^(e)	
Feb-Mar	0.5 ^(e)	

Bermudagrass - Naturally Occurring or Modified Sand based Fields ^a		
When to Apply^b	Lbs/1,000 ft² Nitrogen^c	First Fall Killing Frost Date^b
April 15 - May 15	0.5 - 0.7 ^(c)	Before Oct. 20
June	0.7 ^(c)	
July	0.7 ^(c)	
August	0.7 ^(c)	
Sept 1 - Sept 15	0.7 ^(c)	After Oct. 20
If overseeded with perennial ryegrass		
Oct - Nov	0.5 ^(e)	
Feb - Mar	0.5 ^(e)	

The following notes apply to both of the Bermudagrass tables above:

- (a) In the Piedmont and the Ridge and Valley areas of Virginia, the existing native soil will normally be comprised predominantly of clay and/or silt and these soils have inherently

lower water infiltration and percolation rates and greater nutrient holding capacity. However, most areas of the Coastal Plain have existing native soils that are predominantly sandy textured soils and other facilities throughout the state may choose to install modified soil root zones that are predominantly sand (>50%) in order to maximize drainage and reduce compaction tendency. If subsurface drain tile surrounded by sand and/or gravel has been installed under the playing surface of any of these fields, their nitrogen programs should be managed as predominantly sand-based systems to minimize nutrient leaching.

- (b) The beginning and ending dates for application of nitrogen shall be determined using guidance and frost date maps contained in the Season of Application for Nitrogen section, Figures 6-1 and 6-2.
- (c) WSN must be applied as two applications not to exceed 0.35 pounds per 1,000 ft² each with a minimum of 15 days between applications. Alternatively, using a material that contains slowly available nitrogen sources, split applications of 0.5 pounds per 1,000 ft² may be applied with a minimum of 15 days between applications.
- (d) If a material containing slowly available forms of nitrogen is used, rates up to 1.0 pounds of nitrogen per 1,000 ft² may be applied in a single application with a minimum of 30 days between applications.
- (e) For overseeded warm season grasses, an additional 0.7 pounds per 1,000ft² of WSN may be applied in the Fall after the perennial ryegrass overseeding is well established. The WSN must be applied as two applications not to exceed 0.35 pounds per 1,000 ft² of nitrogen each, with a minimum of 15 days between applications. Additional WSN application of 0.5 pounds per 1,000 ft² may be made in February-March to overseeded perennial ryegrass if growth and color indicate need. Alternatively, split applications of 0.5 pounds of nitrogen per 1,000 ft² each with a minimum of 15 days between applications may be applied using a material containing slowly available nitrogen sources.

Phosphorus and Potassium Recommendations Athletic Fields

Apply phosphorus (P₂O₅) and potassium (K₂O) fertilizers as indicated by a soil test using the following guidelines:

<u>Soil Test Level</u>	<u>Nutrient Needs (pounds per 1000 ft²)*</u>	
	P₂O₅	K₂O
L	2-3	2-3
M	1-2	1-2
H	0.5-1	0.5-1
VH	0	0

- * For the lower soil test level within a rating, use the higher side of the range and for higher soil test level within a rating use the lower side of the recommendation range.
- For irrigated turf grown on Naturally Occurring and Modified Sand Based soils only, up to 0.5 pounds of P₂O₅ per 1,000 ft² may be applied, if needed, to aid in recovery of damaged turf during times of extreme use. No phosphorus applications shall be made when the soil phosphorus test level is above 65% saturation, based on the soil test phosphorus values and region as listed in Table 4-1 of Section IV.
- Avoid the general use of high phosphorus ratio fertilizers such as 10-10-10 or 5-10-10, unless soil tests indicate phosphorus availability below the M+ level.

Establishment/Grow-In Recommendations for Golf Courses, Athletic Fields,

and Sod Production

(These rates replace normal maintenance fertilizer applications that would have occurred during these time periods.)

Warm Season Grasses:

Predominantly Silt/Clay Soils

- ◆ Plant Date - late May - June for sprigs, plugs, sod, or seeding.
- ◆ Apply P_2O_5 and K_2O as needed based on soil test recommendations, incorporate into the top 2 inches if possible.
- ◆ At Planting - Up to 1.0 pounds of nitrogen per 1,000 ft² using a material containing slowly available forms of nitrogen may be applied as one application or lesser amounts applied at regular intervals, through the first 4 weeks, not to exceed a total of 1.0 pounds of nitrogen per 1,000 ft².
- ◆ Four weeks after planting - 0.25 pounds of WSN per 1,000 ft² per week for the next 4 weeks.

Naturally Occurring or Modified Sand Based Soils

- ◆ Plant Date - late May - June for sprigs, plugs, sod, or seeding.
- ◆ Apply P_2O_5 and K_2O as needed based on soil test recommendations, incorporate into the top 2 inches if possible.
- ◆ At Planting - Up to 1.0 pounds of nitrogen per 1,000 ft² using a material containing slowly available forms of nitrogen may be applied as one application or lesser amounts applied at regular intervals, through the first 4 weeks, not to exceed a total of 1.0 pounds of nitrogen per 1,000 ft².
- ◆ Four weeks after planting - 0.25 pounds per 1,000 ft² using a material containing slowly available forms of nitrogen per week for the next 4 weeks.

Cool Season Grasses:

Predominantly Silt/Clay Soils

- ◆ Plant Date - August - September (preferred)
- ◆ Apply P_2O_5 and K_2O as needed based on soil test recommendations, incorporate into the top 2 inches if possible.
- ◆ At Planting - up to 0.9 pounds of nitrogen per 1,000 ft² using a material containing slowly available forms of nitrogen may be applied; 30 days after planting, apply up to 0.5 pounds of nitrogen per 1,000 ft² every week for the next 4 weeks.

Naturally Occurring or Modified Sand Based Soils

- ◆ Plant Date - August - September (preferred)
- ◆ Apply P_2O_5 and K_2O as needed based on soil test recommendations, incorporate into the top 2 inches if possible.
- ◆ At Planting - up to 0.9 lbs pounds of nitrogen per 1,000 ft² using a using a material containing slowly available forms of nitrogen may be applied.
- ◆ Apply up to 0.25 pounds of nitrogen per 1,000 ft² per week after germination is complete, for the next 8 weeks. If using a material containing slowly available forms of nitrogen, up to 0.5 pounds of nitrogen per 1,000 ft² every two weeks may be applied after germination is complete for the next 8 weeks.

Sod Installations:

Site preparation should include a soil test, which can be done several months before the project begins in order to have time to get test results back. Phosphorus, potassium and lime applications should be based on soil test analysis to increase the likelihood of a successful installation. Shallow incorporation of material into the top 2 inches of the soil is preferred prior to sod installation, especially if lime is required.

No more than 0.7 pounds of nitrogen per 1,000 ft² of WSN may be applied before sod is installed. Alternatively, using a material with slowly available forms of nitrogen, 0.9 pounds of nitrogen per 1,000 ft² for cool season grasses or 1.0 pounds of nitrogen per 1,000 ft² for warm season grasses may be applied before sod is installed.

After installation apply adequate amounts of water to maintain sufficient soil moisture (i.e. to prevent visible wilt symptoms). Excessive water will limit initial root development. After roots begin to establish (as verified by lightly tugging on the sod pieces), shift irrigation strategy to a deep and infrequent program in order to encourage deep root growth. Apply approximately 1 inch of water per week (either by rainfall or irrigation), making sure that the water is being accepted by the soil profile without running off. This will insure thorough wetting of the soil profile.

After sod has completed rooting and is well established, initiate the normal nitrogen management program as described for the appropriate use shall be recommended.

Phosphorus and Potassium Recommendations for Establishment/Grow-In/Installation

<u>Soil Test Level</u>	<u>Nutrient Needs (pounds per</u>	
	<u>1000 ft²) *</u>	
	<u>P₂O₅</u>	<u>K₂O</u>
L	3-4	2-3
M	2-3	1-2
H	2-1	0.5-1
VH	0	0

- * For the lower soil test level within a rating, use the higher side of the range and for higher soil test level within a rating use the lower side of the recommendation range.

Other Turf Management Considerations for Golf Courses, Athletic fields, and Home Lawns

Lime Recommendations

Lime should be recommended based on a soil test to maintain soil pH within an agronomic range for turfgrass.

For new seedings where lime is recommended, incorporate the lime into the topsoil for best results.

Returning Grass Clippings

Recycling of clippings on turf should be encouraged as an effective means of recycling nitrogen, phosphorus, and potassium. Proper mowing practices that ensure no more than 1/3 of the leaf blade is removed in any cutting event will enhance turf appearance and performance when clippings are returned. Return all leaf clippings from mowing events to the turf rather than discharging them onto sidewalks or streets. Rotary mulching mowers can further enhance clipping recycling by reducing the size of clippings being returned to the turfgrass canopy.

Management of Collected Clippings

If clippings are collected they should be disposed of properly. They may be composted or spread uniformly as a thin layer over other turf areas or areas where the nutrient content of the clippings can be recycled through actively growing plants. They should not be blown onto impervious surfaces or surface waters, dumped down stormwater drains, or piled outside where rainwater will leach out the nutrients creating the potential for nutrient loss to the environment.

Use of Iron

Iron applications (particularly foliar applications) may periodically be used for enhanced greening as an alternative to nitrogen. These applications are most beneficial if applied in late spring through summer for cool season grasses and in late summer/fall applications for warm-season grasses.

Impervious Surfaces

Do not apply fertilizers containing nitrogen or phosphorus to impervious surfaces (sidewalks, streets, etc.). Remove any granular materials that land on impervious surfaces by sweeping and collecting, and either put the collected material back in the bag, or spread it onto the turf and /or using a leaf blower etc. to return the fertilizer back to the turfgrass canopy.