

## Alfalfa - New Seeding

### Crop Highlights

- Always inoculate seed. If in doubt of the inoculum's viability, re-apply inoculum.
- Roundup Ready™ alfalfa is now available; follow label directions carefully for success.
- Soil pH is critical for successful establishment and long term productivity as are good soil test P and K levels. Test and correct any issues prior to seeding.
- Late-summer / early fall seedings are most likely to succeed.

### Yield Goal

Yield goals are not made for new seedings of perennial forages. Instead, these recommendations are designed to promote good establishment of the forage for future productivity and discourage weed competition.

### Target pH: 6.8

1. If soil pH is 5.0 or less, soil is too acid for establishment of alfalfa. Apply lime at the recommended rate and incorporate thoroughly. Do not seed immediately. Instead, plant a different crop and re-test the soil in 6 to 12 months to determine if pH has been adequately corrected.
2. If soil pH is between 5.1 and 5.5, soil is too acid for good growth of alfalfa. Apply lime at the recommended rate and plow down prior to seeding.

### Recommended Liming Source:

**Table 1. Recommended type of lime as a function of soil test Ca and Mg concentrations.**

Soil Test Levels	Recommended Lime Type
Soil Test Mg less than 50 FIVs	Dolomitic
Soil Test Mg between 50 and 100 FIVs AND LESS than Soil Test Ca	Dolomitic
Soil Test Mg greater than 100 FIVs	Calcitic
Soil Test Mg GREATER than 50 FIVs AND GREATER than Soil Test Ca	Calcitic

### Nitrogen:

1. Nitrogen (N) application is not recommended for legumes, however, up to 30 lbs N/ac can be applied to encourage growth without having a negative impact on nitrogen fixation.
2. Apply the appropriate inoculant and/or use inoculated seed.
3. If nodulation failure occurs, you may need to apply N to support crop growth until nodulation takes place. Contact your county agent for further assistance.

## Phosphorus

**Table 2. Recommended phosphorus rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P <sub>2</sub> O <sub>5</sub> /ac	210	190	170	150	130	100	80	60	40	20	0

1. If soil test P is “Low” or “Medium” (e.g., 50 FIVs or less), broadcast and plow down the recommended rate of phosphate prior to seeding.
2. If soil test P is “Optimum” (e.g., 51 to 100 FIVs), broadcast and incorporate phosphate prior to seeding or surface broadcast at or shortly after planting.
3. If soil test P is “Excessive” (e.g., greater than 100 FIVs), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

## Potassium

**Table 3. Recommended potassium rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs K <sub>2</sub> O/ac	320	280	240	200	160	120	100	80	60	45	0

1. For new plantings using conventional tillage where applied nutrients can be worked into the top 6 to 8 inches of the soil, apply the recommended rate of potash as a broadcast application and incorporate thoroughly into the soil at or prior to seeding.
2. An additional application of 30 to 60 lbs K<sub>2</sub>O/ac broadcast over the new planting in late August or early September will help the new forage with winter survival.
3. For new plantings using no-till or minimum tillage techniques where the recommended application rate of potash is **greater than 120 lbs K<sub>2</sub>O /ac**, split the recommended rate into two treatments. Apply one-half at or prior to seeding and the remainder in late August or September.

## Magnesium

1. Magnesium (Mg) is recommended when soil test Mg is less than 38 FIVs to reduce the risk of grass tetany, especially in the spring.
2. If soil test Mg is less than 38 FIVs and lime is recommended, use dolomitic limestone.
3. If soil test Mg is less than 38 FIVs and lime is not needed, apply soluble Mg according to the rates in Table 4, below.

**Table 4. Recommended application rates of soluble magnesium as a function of soil test Mg index value.**

Soluble Mg	UD FIVs									
	0	5	10	15	20	25	30	35	40	
lbs soluble Mg/ac	80	70	60	50	40	30	20	10	0	

## Sulfur

1. Apply 20 - 40 lbs S/ac to ensure that adequate sulfur is available to meet crop needs.
2. Broadcast S prior to seeding.

- Sulfate-S is available for crop uptake immediately after application. If a reduced form of S is applied (e.g., thiosulfate or elemental S), allow adequate time for oxidation of the applied S to the sulfate form to occur.

## Manganese

Manganese (Mn) needs are predicted by an Availability Index that includes M3 soil test Mn and soil pH. Interpretation is crop specific.

$$\text{MnAI} = 101.7 - (15.2 \times \text{soil pH}) + (2.11 \times \text{M3-Mn})$$

Where:

- MnAI = Mn availability index  
 Soil pH = Soil pH measured in water (1:1 V:V)  
 M3-Mn = Mehlich 3 soil test Mn in lbs/ac

**Table 5. Interpretation of Mn availability index.**

Mn Availability Index	Interpretation
Less than 12	Mn deficiency is possible. Monitor the crop for symptoms
12 or greater	Mn deficiency is unlikely.

- If Mn deficiency is predicted or was observed in the previous growing season, broadcast 20-40 lbs actual Mn/ac.
- Broadcast applications of acid forming fertilizers may correct Mn deficiency without the actual application of Mn in some cases, but may be less effective than applications of Mn. Long term application of acid forming fertilizers will require pH correction with lime.
- If Mn deficiency symptoms appear during the growing season or after an application of lime, a foliar application of 0.5 to 2.0 lbs/ac actual Mn as Mn sulfate or chelated Mn can alleviate the symptoms and restore yield potential. **Apply only when adequate growth is present to aid absorption of foliar Mn.** Foliar application can be repeated if symptoms reappear.

## Zinc

Zinc (Zn) deficiency is predicted by an Availability Index that includes not only M3 soil test Zn, but also soil pH and M3 soil test P.

**Table 6. Interpretation of Zn availability index.**

Soil Test Criteria	Interpretation
M3-Zn is less than 1.9 lbs/ac	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is 6.6 or higher <b>AND</b> M3-P is 100 FIVs or higher	Zn deficiency is predicted
M3-Zn is 3.2 lbs/ac or higher	Soil should be sufficient in Zn

If zinc deficiency is predicted by the availability index or was observed the previous year, one of the following treatments can be applied:

1. Broadcast 10-12 lbs/ac actual Zn as Zn sulfate or Zn oxide or 2-3 lbs/ac actual Zn as Zn chelate. Broadcast applications should correct Zn deficiency for several years.
2. Foliar application of 1 lb/ac actual Zn as Zn sulfate or Zn oxide or 0.5 lb/ac actual Zn as Zn chelate in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

## **Boron**

1. Apply 2.0 - 4.0 lbs B/ac.
2. Boron (B) can be applied in a blended, broadcast fertilizer, as a soil spray or applied in a foliar spray, generally in late May or June. **Foliar applications should only be made when adequate growth is present to aid absorption of foliar B.**
3. **Caution:** Although B is required for maximum productivity of hay fields containing legumes, even slight over-application can be toxic to the crop. When applying B as a foliar spray, be certain to apply the correct rate.

### Alfalfa/Grass Mixed - New Seeding

Crop Highlights
<ul style="list-style-type: none"> <li>• Always inoculate alfalfa seed. If in doubt of the inoculum’s viability, re-apply inoculum</li> <li>• Roundup Ready™ alfalfa is unsuited for this use</li> <li>• N Management can alter alfalfa:grass proportions</li> <li>• High pH, P, and K can favor the legume component</li> <li>• Requires careful management to control weeds</li> </ul>

#### Yield Goal

Yield goals are not made for new seedings of perennial forages. Instead, these recommendations are designed to promote good establishment of the forage for future productivity and discourage weed competition.

**Target pH: 6.8**

#### Recommended Liming Source:

**Table 1. Recommended type of lime as a function of soil test Ca and Mg concentrations.**

Soil Test Levels	Recommended Lime Type
Soil Test Mg less than 50 FIVs	Dolomitic
Soil Test Mg between 50 and 100 FIVs AND LESS than Soil Test Ca	Dolomitic
Soil Test Mg greater than 100 FIVs	Calcitic
Soil Test Mg GREATER than 50 FIVs AND GREATER than Soil Test Ca	Calcitic

#### Nitrogen:

1. For late summer, fall or very early spring seedings, if little weed competition is expected, apply 20 lbs N/ac at or prior to planting to encourage establishment and growth.
2. For mid- to late spring seedings, do not apply N until the grass seedlings are 2-4 inches tall to avoid stimulating weed competition. When growth reaches that height and if weed pressure is not at a competitive level, broadcast 20 - 30 lbs N/ac.
3. Nitrogen application is not recommended if the seeding mix contains legumes, however, up to 30 lbs N/ac can be applied to encourage growth without having a negative impact on nitrogen fixation.
4. Apply the appropriate inoculant for alfalfa and/or use inoculated seed.
5. Nitrogen application is not recommended if the available forage contains at least 25% legumes. Applied N makes the grasses more competitive and can result in the loss of legumes.
6. After each cut, evaluate forage composition. If the mix is less than 25% legumes and soil moisture is adequate for good regrowth, apply 40 - 60 lbs N/ac per ton of expected per acre yield for the next cut (e.g., if the expected yield of the next cut is 2 tons/ac, apply 80 - 120 lbs N/ac).
7. Adjust the N application rate as expected yield changes from cut to cut, with expected weather conditions and as forage composition changes.

## Phosphorus

**Table 2. Recommended phosphorus rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P <sub>2</sub> O <sub>5</sub> /ac	210	190	170	150	130	100	80	60	40	20	0

1. If soil test P is “Low” or “Medium” (e.g., 50 FIVs or less), broadcast and plow down the recommended rate of phosphate prior to seeding.
2. If soil test P is “Optimum” (e.g., 51 to 100 FIVs), broadcast and incorporate phosphate prior to seeding or surface broadcast at or shortly after planting.
3. If soil test P is “Excessive” (e.g., greater than 100 FIVs), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

## Potassium

**Table 3. Recommended potassium rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs K <sub>2</sub> O/ac	320	280	240	200	160	120	100	80	60	45	0

1. For new plantings using conventional tillage where applied nutrients can be worked into the top 6 to 8 inches of the soil, apply the recommended rate of potash as a broadcast application and incorporate thoroughly into the soil at or prior to seeding.
2. An additional application of 30 to 60 lbs K<sub>2</sub>O/ac broadcast over the new planting in late August or early September will help the new forage with winter survival.
3. For new plantings using no-till or minimum tillage techniques where the recommended application rate of potash is **greater than 120 lbs K<sub>2</sub>O /ac**, split the recommended rate into two treatments. Apply one-half at or prior to seeding and the remainder in late August or September.

## Magnesium

1. Magnesium (Mg) is recommended when soil test Mg is less than 38 FIVs to reduce the risk of grass tetany, especially in the spring.
2. If soil test Mg is less than 38 FIVs and lime is recommended, use dolomitic limestone.
3. If soil test Mg is less than 38 FIVs and lime is not needed, apply soluble Mg according to the rates in Table 4, below.

**Table 4. Recommended application rates of soluble magnesium as a function of soil test Mg index value.**

Soluble Mg	UD FIVs								
	0	5	10	15	20	25	30	35	40
lbs soluble Mg/ac	80	70	60	50	40	30	20	10	0

## Sulfur

1. Apply 20 - 40 lbs S/ac to ensure that adequate sulfur is available to meet crop needs.
2. Broadcast S prior to seeding.

- Sulfate-S is available for crop uptake immediately after application. If a reduced form of S is applied (e.g., thiosulfate or elemental S), allow adequate time for oxidation of the applied S to the sulfate form to occur.

## Manganese

Manganese (Mn) needs are predicted by an Availability Index that includes M3 soil test Mn and soil pH. Interpretation is crop specific.

$$\text{MnAI} = 101.7 - (15.2 \times \text{soil pH}) + (2.11 \times \text{M3-Mn})$$

Where:

- MnAI = Mn availability index  
 Soil pH = Soil pH measured in water (1:1 V:V)  
 M3-Mn = Mehlich 3 soil test Mn in lbs/ac

**Table 5. Interpretation of Mn availability index.**

Mn Availability Index	Interpretation
Less than 12	Mn deficiency is possible. Monitor the crop for symptoms
12 or greater	Mn deficiency is unlikely.

- If Mn deficiency is predicted or was observed in the previous growing season, broadcast 20-40 lbs actual Mn/ac.
- Broadcast applications of acid forming fertilizers may correct Mn deficiency without the actual application of Mn in some cases, but may be less effective than applications of Mn. Long term application of acid forming fertilizers will require pH correction with lime.
- If Mn deficiency symptoms appear during the growing season or after an application of lime, a foliar application of 0.5 to 2.0 lbs/ac actual Mn as Mn sulfate or chelated Mn can alleviate the symptoms and restore yield potential. **Apply only when adequate growth is present to aid absorption of foliar Mn.** Foliar application can be repeated if symptoms reappear.

## Zinc

Zinc (Zn) deficiency is predicted by an Availability Index that includes not only M3 soil test Zn, but also soil pH and M3 soil test P.

**Table 6. Interpretation of Zn availability index.**

Soil Test Criteria	Interpretation
M3-Zn is less than 1.9 lbs/ac	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is 6.6 or higher <b>AND</b> M3-P is 100 FIVs or higher	Zn deficiency is predicted
M3-Zn is 3.2 lbs/ac or higher	Soil should be sufficient in Zn

If zinc deficiency is predicted by the availability index or was observed the previous year, one of the following treatments can be applied:

1. Broadcast 10-12 lbs/ac actual Zn as Zn sulfate or Zn oxide or 2-3 lbs/ac actual Zn as Zn chelate. Broadcast applications should correct Zn deficiency for several years.
2. Foliar application of 1 lb/ac actual Zn as Zn sulfate or Zn oxide or 0.5 lb/ac actual Zn as Zn chelate in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

## **Boron**

1. Apply 1.0 - 2.0 lbs B/ac.
2. Boron (B) can be applied in a blended, broadcast fertilizer, as a soil spray or applied in a foliar spray, generally in late May or June. **Foliar applications should only be made when adequate growth is present to aid absorption of foliar B.**
3. **Caution:** Although B is required for maximum productivity of hay fields containing legumes, even slight over-application can be toxic to the crop. When applying B as a foliar spray, be certain to apply the correct rate.

### **Brassica / Grass Mix - New Seeding**

<b>Crop Highlights</b>
<ul style="list-style-type: none"> <li>• Relatively inexpensive, emergency forage option</li> <li>• Can provide quick, abundant feed of high digestibility, energy, and protein</li> <li>• Easy establishment using a no-till drill on established pasture</li> <li>• Useful as emergency forage or for extending the grazing season</li> <li>• Useful for flushing ewes or putting weight on lambs</li> </ul>

#### **Yield Goal**

Yield goals are not made for new seedings of perennial forages. Instead, these recommendations are designed to promote good establishment of the forage for future productivity and discourage weed competition.

**Target pH: 6.2**

**Recommended Liming Source:**

**Table 1. Recommended type of lime as a function of soil test Ca and Mg concentrations.**

<b>Soil Test Levels</b>	<b>Recommended Lime Type</b>
Soil Test Mg less than 50 FIVs	Dolomitic
Soil Test Mg between 50 and 100 FIVs AND LESS than Soil Test Ca	Dolomitic
Soil Test Mg greater than 100 FIVs	Calcitic
Soil Test Mg GREATER than 50 FIVs AND GREATER than Soil Test Ca	Calcitic

#### **Nitrogen:**

1. For late summer, fall or very early spring seedings, if little weed competition is expected, apply 20 lbs N/ac at or prior to planting.
2. For mid- to late spring seedings, do not apply N until the seedlings are 2-4 inches tall to avoid stimulating weed competition. When forage growth reaches that height and if weed pressure is not at a competitive level, broadcast 20 - 30 lbs N/ac.
3. After each cut, if soil moisture is adequate for good regrowth, apply 40 - 60 lbs N/ac per ton of expected per acre yield for the next cut (e.g., if the expected yield of the next cut is 2 tons/ac, apply 80 - 120 lbs N/ac).
4. Adjust the N application rate as expected yield changes from cut to cut and with expected weather conditions.

## Phosphorus

**Table 2. Recommended phosphorus rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P <sub>2</sub> O <sub>5</sub> /ac	120	110	100	85	75	65	50	40	25	10	0

1. If soil test P is “Low” or “Medium” (e.g., 50 FIVs or less), broadcast and plow down the recommended rate of phosphate prior to seeding.
2. If soil test P is “Optimum” (e.g., 51 to 100 FIVs), broadcast and incorporate phosphate prior to seeding or surface broadcast at or shortly after planting.
3. If soil test P is “Excessive” (e.g., greater than 100 FIVs), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

## Potassium

**Table 3. Recommended potassium rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs K <sub>2</sub> O/ac	180	165	150	135	120	105	90	75	60	45	0

1. For new plantings using conventional tillage where applied nutrients can be worked into the top 6 to 8 inches of the soil, apply the recommended rate of potash as a broadcast application and incorporate thoroughly into the soil at or prior to seeding.
2. An additional application of 30 to 60 lbs K<sub>2</sub>O/ac broadcast over the new planting in late August or early September will help the new forage with winter survival.
3. For new plantings using no-till or minimum tillage techniques where the recommended application rate of potash is **greater than 120 lbs K<sub>2</sub>O /ac**, split the recommended rate into two treatments. Apply one-half at or prior to seeding and the remainder in late August or September.

## Magnesium

1. Magnesium (Mg) is recommended when soil test Mg is less than 38 FIVs to reduce the risk of grass tetany, especially in the spring.
2. If soil test Mg is less than 38 FIVs and lime is recommended, use dolomitic limestone.
3. If soil test Mg is less than 38 FIVs and lime is not needed, apply soluble Mg according to the rates in Table 4, below.

**Table 4. Recommended application rates of soluble magnesium as a function of soil test Mg index value.**

Soluble Mg	UD FIVs									
	0	5	10	15	20	25	30	35	40	
lbs soluble Mg/ac	80	70	60	50	40	30	20	10	0	

## Sulfur

1. Apply 20 - 40 lbs S/ac to ensure that adequate sulfur is available to meet crop needs.

- Broadcast S prior to seeding or use ammonium sulfate as an N source to supply needed S.
- Sulfate-S is available for crop uptake immediately after application. If a reduced form of S is applied (e.g., thiosulfate or elemental S), allow adequate time for oxidation of the applied S to the sulfate form to occur.

## Manganese

Manganese (Mn) needs are predicted by an Availability Index that includes M3 soil test Mn and soil pH. Interpretation is crop specific.

$$\text{MnAI} = 101.7 - (15.2 \times \text{soil pH}) + (2.11 \times \text{M3-Mn})$$

Where:

- MnAI = Mn availability index
- Soil pH = Soil pH measured in water (1:1 V:V)
- M3-Mn = Mehlich 3 soil test Mn in lbs/ac

**Table 5. Interpretation of Mn availability index.**

Mn Availability Index	Interpretation
Less than 12	Mn deficiency is possible. Monitor the crop for symptoms
12 or greater	Mn deficiency is unlikely.

- If Mn deficiency is predicted or was observed in the previous growing season, broadcast 20-40 lbs actual Mn/ac.
- Broadcast applications of acid forming fertilizers may correct Mn deficiency without the actual application of Mn in some cases, but may be less effective than applications of Mn. Long term application of acid forming fertilizers will require pH correction with lime.
- If Mn deficiency symptoms appear during the growing season or after an application of lime, a foliar application of 0.5 to 2.0 lbs/ac actual Mn as Mn sulfate or chelated Mn can alleviate the symptoms and restore yield potential. **Apply only when adequate growth is present to aid absorption of foliar Mn.** Foliar application can be repeated if symptoms reappear.

## Zinc

Zinc (Zn) deficiency is predicted by an Availability Index that includes not only M3 soil test Zn, but also soil pH and M3 soil test P.

**Table 6. Interpretation of Zn availability index.**

Soil Test Criteria	Interpretation
M3-Zn is less than 1.9 lbs/ac	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is 6.6 or higher <b>AND</b> M3-P is 100 FIVs or higher	Zn deficiency is predicted
M3-Zn is 3.2 lbs/ac or higher	Soil should be sufficient in Zn

If zinc deficiency is predicted by the availability index or was observed the previous year, one of the following treatments can be applied:

1. Broadcast 10-12 lbs/ac actual Zn as Zn sulfate or Zn oxide or 2-3 lbs/ac actual Zn as Zn chelate. Broadcast applications should correct Zn deficiency for several years.
2. Foliar application of 1 lb/ac actual Zn as Zn sulfate or Zn oxide or 0.5 lb/ac actual Zn as Zn chelate in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

## **Boron**

1. Boron (B) deficiency is not usually observed in this crop. If B deficiency symptoms appear, contact your county agent for assistance with diagnosis and corrective recommendations.

### Chicory / Grass Mix - New Seeding

Crop Highlights
<ul style="list-style-type: none"> <li>• Deep-rooted, perennial, Drought-tolerant, high yielding alternative forage</li> <li>• Control bolting with rotational grazing management</li> <li>• Begin grazing at 8 to 10 inches and stop at 1-2 inches of residual growth</li> <li>• Beneficial for small ruminant grazing</li> </ul>

#### Yield Goal

Yield goals are not made for new seedings of perennial forages. Instead, these recommendations are designed to promote good establishment of the forage for future productivity and discourage weed competition.

**Target pH: 5.8**

**Recommended Liming Source:**

**Table 1. Recommended type of lime as a function of soil test Ca and Mg concentrations.**

Soil Test Levels	Recommended Lime Type
Soil Test Mg less than 50 FIVs	Dolomitic
Soil Test Mg between 50 and 100 FIVs AND LESS than Soil Test Ca	Dolomitic
Soil Test Mg greater than 100 FIVs	Calcitic
Soil Test Mg GREATER than 50 FIVs AND GREATER than Soil Test Ca	Calcitic

#### Nitrogen:

1. For late summer, fall or very early spring seedings, if little weed competition is expected, apply 20 lbs N/ac at or prior to planting.
2. For mid- to late spring seedings, do not apply N until the seedlings are 2-4 inches tall to avoid stimulating weed competition. When forage growth reaches that height and if weed pressure is not at a competitive level, broadcast 20 - 30 lbs N/ac.
3. After each cut, if soil moisture is adequate for good regrowth, apply 40 - 60 lbs N/ac per ton of expected per acre yield for the next cut (e.g., if the expected yield of the next cut is 2 tons/ac, apply 80 - 120 lbs N/ac).
4. Adjust the N application rate as expected yield changes from cut to cut and with expected weather conditions.

#### Phosphorus

**Table 2. Recommended phosphorus rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P <sub>2</sub> O <sub>5</sub> /ac	120	110	100	85	75	65	50	40	25	10	0

1. If soil test P is “Low” or “Medium” (e.g., 50 FIVs or less), broadcast and plow down the recommended rate of phosphate prior to seeding.
2. If soil test P is “Optimum” (e.g., 51 to 100 FIVs), broadcast and incorporate phosphate prior to seeding or surface broadcast at or shortly after planting.
3. If soil test P is “Excessive” (e.g., greater than 100 FIVs), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

## Potassium

**Table 3. Recommended potassium rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs K <sub>2</sub> O/ac	180	165	150	135	120	105	90	75	60	45	0

1. For new plantings using conventional tillage where applied nutrients can be worked into the top 6 to 8 inches of the soil, apply the recommended rate of potash as a broadcast application and incorporate thoroughly into the soil at or prior to seeding.
2. An additional application of 30 to 60 lbs K<sub>2</sub>O/ac broadcast over the new planting in late August or early September will help the new forage with winter survival.
3. For new plantings using no-till or minimum tillage techniques where the recommended application rate of potash is **greater than 120 lbs K<sub>2</sub>O /ac**, split the recommended rate into two treatments. Apply one-half at or prior to seeding and the remainder in late August or September.

## Magnesium

1. Magnesium (Mg) is recommended when soil test Mg is less than 38 FIVs to reduce the risk of grass tetany, especially in the spring.
2. If soil test Mg is less than 38 FIVs and lime is recommended, use dolomitic limestone.
3. If soil test Mg is less than 38 FIVs and lime is not needed, apply soluble Mg according to the rates in Table 4, below.

**Table 4. Recommended application rates of soluble magnesium as a function of soil test Mg index value.**

Soluble Mg	UD FIVs								
	0	5	10	15	20	25	30	35	40
lbs soluble Mg/ac	80	70	60	50	40	30	20	10	0

## Sulfur

1. Apply 20 - 40 lbs S/ac to ensure that adequate sulfur is available to meet crop needs.
2. Broadcast S prior to seeding or use ammonium sulfate as an N source to supply needed S.
3. Sulfate-S is available for crop uptake immediately after application. If a reduced form of S is applied (e.g., thiosulfate or elemental S), allow adequate time for oxidation of the applied S to the sulfate form to occur.

## Manganese

Manganese (Mn) needs are predicted by an Availability Index that includes M3 soil test Mn and soil pH. Interpretation is crop specific.

$$\text{MnAI} = 101.7 - (15.2 \times \text{soil pH}) + (2.11 \times \text{M3-Mn})$$

Where:

- MnAI = Mn availability index
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- M3-Mn = Mehlich 3 soil test Mn in lbs/ac

**Table 5. Interpretation of Mn availability index.**

Mn Availability Index	Interpretation
Less than 12	Mn deficiency is possible. Monitor the crop for symptoms
12 or greater	Mn deficiency is unlikely.

- If Mn deficiency is predicted or was observed in the previous growing season, broadcast 20-40 lbs actual Mn/ac.
- Broadcast applications of acid forming fertilizers may correct Mn deficiency without the actual application of Mn in some cases, but may be less effective than applications of Mn. Long term application of acid forming fertilizers will require pH correction with lime.
- If Mn deficiency symptoms appear during the growing season or after an application of lime, a foliar application of 0.5 to 2.0 lbs/ac actual Mn as Mn sulfate or chelated Mn can alleviate the symptoms and restore yield potential. **Apply only when adequate growth is present to aid absorption of foliar Mn.** Foliar application can be repeated if symptoms reappear.

## Zinc

Zinc (Zn) deficiency is predicted by an Availability Index that includes not only M3 soil test Zn, but also soil pH and M3 soil test P.

**Table 6. Interpretation of Zn availability index.**

Soil Test Criteria	Interpretation
M3-Zn is less than 1.9 lbs/ac	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is 6.6 or higher <b>AND</b> M3-P is 100 FIVs or higher	Zn deficiency is predicted
M3-Zn is 3.2 lbs/ac or higher	Soil should be sufficient in Zn

If zinc deficiency is predicted by the availability index or was observed the previous year, one of the following treatments can be applied:

- Broadcast 10-12 lbs/ac actual Zn as Zn sulfate or Zn oxide or 2-3 lbs/ac actual Zn as Zn chelate. Broadcast applications should correct Zn deficiency for several years.
- Foliar application of 1 lb/ac actual Zn as Zn sulfate or Zn oxide or 0.5 lb/ac actual Zn as Zn chelate in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

## **Boron**

1. Boron (B) deficiency is not usually observed in this crop. If B deficiency symptoms appear, contact your county agent for assistance with diagnosis and corrective recommendations.

### Kentucky Bluegrass - New Seeding

Crop Highlights
<ul style="list-style-type: none"> <li>• Can take 2 to 3 weeks to germinate; longer to emerge</li> <li>• Don't plant bluegrass seed too deep</li> <li>• Hold back N fertilizer until the grass is 2-3 inches tall</li> <li>• Produces most forage during cool of spring; some in fall</li> </ul>

#### Yield Goal

Yield goals are not made for new seedings of perennial forages. Instead, these recommendations are designed to promote good establishment of the forage for future productivity and discourage weed competition.

**Target pH: 6.5**

**Recommended Liming Source:**

**Table 1. Recommended type of lime as a function of soil test Ca and Mg concentrations.**

Soil Test Levels	Recommended Lime Type
Soil Test Mg less than 50 FIVs	Dolomitic
Soil Test Mg between 50 and 100 FIVs AND LESS than Soil Test Ca	Dolomitic
Soil Test Mg greater than 100 FIVs	Calcitic
Soil Test Mg GREATER than 50 FIVs AND GREATER than Soil Test Ca	Calcitic

#### Nitrogen:

1. For late summer, fall or very early spring seedings, if little weed competition is expected, apply 20 lbs N/ac at or prior to planting.
2. For mid- to late spring seedings, do not apply N until the seedlings are 2-4 inches tall to avoid stimulating weed competition. When forage growth reaches that height and if weed pressure is not at a competitive level, broadcast 20 - 30 lbs N/ac.
3. After each cut, if soil moisture is adequate for good regrowth, apply 40 - 60 lbs N/ac per ton of expected per acre yield for the next cut (e.g., if the expected yield of the next cut is 2 tons/ac, apply 80 - 120 lbs N/ac).
4. Adjust the N application rate as expected yield changes from cut to cut and with expected weather conditions.

#### Phosphorus

**Table 2. Recommended phosphorus rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P <sub>2</sub> O <sub>5</sub> /ac	120	110	100	85	75	65	50	40	25	10	0

1. If soil test P is “Low” or “Medium” (e.g., 50 FIVs or less), broadcast and plow down the recommended rate of phosphate prior to seeding.
2. If soil test P is “Optimum” (e.g., 51 to 100 FIVs), broadcast and incorporate phosphate prior to seeding or surface broadcast at or shortly after planting.
3. If soil test P is “Excessive” (e.g., greater than 100 FIVs), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

## Potassium

**Table 3. Recommended potassium rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs K <sub>2</sub> O/ac	180	165	150	135	120	105	90	75	60	45	0

1. For new plantings using conventional tillage where applied nutrients can be worked into the top 6 to 8 inches of the soil, apply the recommended rate of potash as a broadcast application and incorporate thoroughly into the soil at or prior to seeding.
2. An additional application of 30 to 60 lbs K<sub>2</sub>O/ac broadcast over the new planting in late August or early September will help the new forage with winter survival.
3. For new plantings using no-till or minimum tillage techniques where the recommended application rate of potash is **greater than 120 lbs K<sub>2</sub>O /ac**, split the recommended rate into two treatments. Apply one-half at or prior to seeding and the remainder in late August or September.

## Magnesium

1. Magnesium (Mg) is recommended when soil test Mg is less than 38 FIVs to reduce the risk of grass tetany, especially in the spring.
2. If soil test Mg is less than 38 FIVs and lime is recommended, use dolomitic limestone.
3. If soil test Mg is less than 38 FIVs and lime is not needed, apply soluble Mg according to the rates in Table 4, below.

**Table 4. Recommended application rates of soluble magnesium as a function of soil test Mg index value.**

Soluble Mg	UD FIVs								
	0	5	10	15	20	25	30	35	40
lbs soluble Mg/ac	80	70	60	50	40	30	20	10	0

## Sulfur

1. Apply 20 - 40 lbs S/ac to ensure that adequate sulfur is available to meet crop needs.
2. Broadcast S prior to seeding or use ammonium sulfate as an N source to supply needed S.
3. Sulfate-S is available for crop uptake immediately after application. If a reduced form of S is applied (e.g., thiosulfate or elemental S), allow adequate time for oxidation of the applied S to the sulfate form to occur.

## Manganese

Manganese (Mn) needs are predicted by an Availability Index that includes M3 soil test Mn and soil pH. Interpretation is crop specific.

$$\text{MnAI} = 101.7 - (15.2 \times \text{soil pH}) + (2.11 \times \text{M3-Mn})$$

Where:

- MnAI = Mn availability index
- Soil pH = Soil pH measured in water (1:1 V:V)
- M3-Mn = Mehlich 3 soil test Mn in lbs/ac

**Table 5. Interpretation of Mn availability index.**

Mn Availability Index	Interpretation
Less than 12	Mn deficiency is possible. Monitor the crop for symptoms
12 or greater	Mn deficiency is unlikely.

1. If Mn deficiency is predicted or was observed in the previous growing season, broadcast 20-40 lbs actual Mn/ac.
2. Broadcast applications of acid forming fertilizers may correct Mn deficiency without the actual application of Mn in some cases, but may be less effective than applications of Mn. Long term application of acid forming fertilizers will require pH correction with lime.
3. If Mn deficiency symptoms appear during the growing season or after an application of lime, a foliar application of 0.5 to 2.0 lbs/ac actual Mn as Mn sulfate or chelated Mn can alleviate the symptoms and restore yield potential. **Apply only when adequate growth is present to aid absorption of foliar Mn.** Foliar application can be repeated if symptoms reappear.

## Zinc

Zinc (Zn) deficiency is predicted by an Availability Index that includes not only M3 soil test Zn, but also soil pH and M3 soil test P.

**Table 6. Interpretation of Zn availability index.**

Soil Test Criteria	Interpretation
M3-Zn is less than 1.9 lbs/ac	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is 6.6 or higher <b>AND</b> M3-P is 100 FIVs or higher	Zn deficiency is predicted
M3-Zn is 3.2 lbs/ac or higher	Soil should be sufficient in Zn

If zinc deficiency is predicted by the availability index or was observed the previous year, one of the following treatments can be applied:

1. Broadcast 10-12 lbs/ac actual Zn as Zn sulfate or Zn oxide or 2-3 lbs/ac actual Zn as Zn chelate. Broadcast applications should correct Zn deficiency for several years.
2. Foliar application of 1 lb/ac actual Zn as Zn sulfate or Zn oxide or 0.5 lb/ac actual Zn as Zn chelate in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

## **Boron**

1. Boron (B) deficiency is not usually observed in this crop. If B deficiency symptoms appear, contact your county agent for assistance with diagnosis and corrective recommendations.

### Lespedeza / Sericea - New Seeding

Crop Highlights
<ul style="list-style-type: none"> <li>• Seed alone as does not compete well with other plants</li> <li>• More tolerant of acid soils than clover as well as of infertile droughty soils</li> <li>• Although a legume, little N is shared between this crop and companion grasses</li> <li>• High in condensed tannins that could help control small ruminant parasites</li> </ul>

#### Yield Goal

Yield goals are not made for new seedings of perennial forages. Instead, these recommendations are designed to promote good establishment of the forage for future productivity and discourage weed competition.

**Target pH: 6.2**

#### Recommended Liming Source:

**Table 1. Recommended type of lime as a function of soil test Ca and Mg concentrations.**

Soil Test Levels	Recommended Lime Type
Soil Test Mg less than 50 FIVs	Dolomitic
Soil Test Mg between 50 and 100 FIVs AND LESS than Soil Test Ca	Dolomitic
Soil Test Mg greater than 100 FIVs	Calcitic
Soil Test Mg GREATER than 50 FIVs AND GREATER than Soil Test Ca	Calcitic

#### Nitrogen:

1. Apply no N for new seedings of lespedeza. Lespedeza is not competitive until well established.
2. Apply the appropriate inoculant and/or use inoculated seed.
3. If inoculation failure occurs, contact your county agent for assistance.

#### Phosphorus

**Table 2. Recommended phosphorus rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P <sub>2</sub> O <sub>5</sub> /ac	120	110	100	85	75	65	50	40	25	10	0

1. If soil test P is “Low” or “Medium” (e.g., 50 FIVs or less), broadcast and plow down the recommended rate of phosphate prior to seeding.
2. If soil test P is “Optimum” (e.g., 51 to 100 FIVs), broadcast and incorporate phosphate prior to seeding or surface broadcast at or shortly after planting.

- If soil test P is “Excessive” (e.g., greater than 100 FIVs), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

## Potassium

**Table 3. Recommended potassium rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs K <sub>2</sub> O/ac	180	165	150	135	120	105	90	75	60	45	0

- For new plantings using conventional tillage where applied nutrients can be worked into the top 6 to 8 inches of the soil, apply the recommended rate of potash as a broadcast application and incorporate thoroughly into the soil at or prior to seeding.
- An additional application of 30 to 60 lbs K<sub>2</sub>O/ac broadcast over the new planting in late August or early September will help the new forage with winter survival.
- For new plantings using no-till or minimum tillage techniques where the recommended application rate of potash is **greater than 120 lbs K<sub>2</sub>O /ac**, split the recommended rate into two treatments. Apply one-half at or prior to seeding and the remainder in late August or September.

## Magnesium

- Magnesium (Mg) is recommended when soil test Mg is less than 38 FIVs to reduce the risk of grass tetany, especially in the spring.
- If soil test Mg is less than 38 FIVs and lime is recommended, use dolomitic limestone.
- If soil test Mg is less than 38 FIVs and lime is not needed, apply soluble Mg according to the rates in Table 4, below.

**Table 4. Recommended application rates of soluble magnesium as a function of soil test Mg index value.**

Soluble Mg	UD FIVs								
	0	5	10	15	20	25	30	35	40
lbs soluble Mg/ac	80	70	60	50	40	30	20	10	0

## Sulfur

- Apply 20 - 40 lbs S/ac to ensure that adequate sulfur is available to meet crop needs.
- Broadcast S prior to seeding.
- Sulfate-S is available for crop uptake immediately after application. If a reduced form of S is applied (e.g., thiosulfate or elemental S), allow adequate time for oxidation of the applied S to the sulfate form to occur.

## Manganese

Manganese (Mn) needs are predicted by an Availability Index that includes M3 soil test Mn and soil pH. Interpretation is crop specific.

$$\text{MnAI} = 101.7 - (15.2 \times \text{soil pH}) + (2.11 \times \text{M3-Mn})$$

Where:

- MnAI = Mn availability index
- Soil pH = Soil pH measured in water (1:1 V:V)
- M3-Mn = Mehlich 3 soil test Mn in lbs/ac

**Table 5. Interpretation of Mn availability index.**

Mn Availability Index	Interpretation
Less than 12	Mn deficiency is possible. Monitor the crop for symptoms
12 or greater	Mn deficiency is unlikely.

1. If Mn deficiency is predicted or was observed in the previous growing season, broadcast 20-40 lbs actual Mn/ac.
2. Broadcast applications of acid forming fertilizers may correct Mn deficiency without the actual application of Mn in some cases, but may be less effective than applications of Mn. Long term application of acid forming fertilizers will require pH correction with lime.
3. If Mn deficiency symptoms appear during the growing season or after an application of lime, a foliar application of 0.5 to 2.0 lbs/ac actual Mn as Mn sulfate or chelated Mn can alleviate the symptoms and restore yield potential. **Apply only when adequate growth is present to aid absorption of foliar Mn.** Foliar application can be repeated if symptoms reappear.

## Zinc

Zinc (Zn) deficiency is predicted by an Availability Index that includes not only M3 soil test Zn, but also soil pH and M3 soil test P.

**Table 6. Interpretation of Zn availability index.**

Soil Test Criteria	Interpretation
M3-Zn is less than 1.9 lbs/ac	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is 6.6 or higher <b>AND</b> M3-P is 100 FIVs or higher	Zn deficiency is predicted
M3-Zn is 3.2 lbs/ac or higher	Soil should be sufficient in Zn

If zinc deficiency is predicted by the availability index or was observed the previous year, one of the following treatments can be applied:

1. Broadcast 10-12 lbs/ac actual Zn as Zn sulfate or Zn oxide or 2-3 lbs/ac actual Zn as Zn chelate. Broadcast applications should correct Zn deficiency for several years.
2. Foliar application of 1 lb/ac actual Zn as Zn sulfate or Zn oxide or 0.5 lb/ac actual Zn as Zn chelate in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

## Boron

1. Boron (B) deficiency is not usually observed in this crop. If B deficiency symptoms appear, contact your county agent for assistance with diagnosis and corrective recommendations.

### Annual or Italian Ryegrass - New Seeding

Crop Highlights
<ul style="list-style-type: none"> <li>• There are two subtypes available, one a true annual and the other (Italian) more like a very short-lived perennial</li> <li>• Germinates and emerges in 3 to 7 days</li> <li>• Excellent for extending a legumes (alfalfa) stand life using no-till seeding</li> </ul>

#### Yield Goal

Yield goals are not made for new seedings of perennial forages. Instead, these recommendations are designed to promote good establishment of the forage for future productivity and discourage weed competition.

**Target pH: 6.5**

**Recommended Liming Source:**

**Table 1. Recommended type of lime as a function of soil test Ca and Mg concentrations.**

Soil Test Levels	Recommended Lime Type
Soil Test Mg less than 50 FIVs	Dolomitic
Soil Test Mg between 50 and 100 FIVs AND LESS than Soil Test Ca	Dolomitic
Soil Test Mg greater than 100 FIVs	Calcitic
Soil Test Mg GREATER than 50 FIVs AND GREATER than Soil Test Ca	Calcitic

#### Nitrogen:

1. For late summer, fall or very early spring seedings, if little weed competition is expected, apply 20 lbs N/ac at or prior to planting.
2. For mid- to late spring seedings, do not apply N until the seedlings are 2-4 inches tall to avoid stimulating weed competition. When forage growth reaches that height and if weed pressure is not at a competitive level, broadcast 20 - 30 lbs N/ac.
3. After each cut, if soil moisture is adequate for good regrowth, apply 40 - 60 lbs N/ac per ton of expected per acre yield for the next cut (e.g., if the expected yield of the next cut is 2 tons/ac, apply 80 - 120 lbs N/ac).
4. Adjust the N application rate as expected yield changes from cut to cut and with expected weather conditions.

#### Phosphorus

**Table 2. Recommended phosphorus rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P <sub>2</sub> O <sub>5</sub> /ac	120	110	100	85	75	65	50	40	25	10	0

1. If soil test P is “Low” or “Medium” (e.g., 50 FIVs or less), broadcast and plow down the recommended rate of phosphate prior to seeding.
2. If soil test P is “Optimum” (e.g., 51 to 100 FIVs), broadcast and incorporate phosphate prior to seeding or surface broadcast at or shortly after planting.
3. If soil test P is “Excessive” (e.g., greater than 100 FIVs), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

## Potassium

**Table 3. Recommended potassium rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs K <sub>2</sub> O/ac	180	165	150	135	120	105	90	75	60	45	0

1. For new plantings using conventional tillage where applied nutrients can be worked into the top 6 to 8 inches of the soil, apply the recommended rate of potash as a broadcast application and incorporate thoroughly into the soil at or prior to seeding.
2. An additional application of 30 to 60 lbs K<sub>2</sub>O/ac broadcast over the new planting in late August or early September will help the new forage with winter survival.
3. For new plantings using no-till or minimum tillage techniques where the recommended application rate of potash is **greater than 120 lbs K<sub>2</sub>O /ac**, split the recommended rate into two treatments. Apply one-half at or prior to seeding and the remainder in late August or September.

## Magnesium

1. Magnesium (Mg) is recommended when soil test Mg is less than 38 FIVs to reduce the risk of grass tetany, especially in the spring.
2. If soil test Mg is less than 38 FIVs and lime is recommended, use dolomitic limestone.
3. If soil test Mg is less than 38 FIVs and lime is not needed, apply soluble Mg according to the rates in Table 4, below.

**Table 4. Recommended application rates of soluble magnesium as a function of soil test Mg index value.**

Soluble Mg	UD FIVs								
	0	5	10	15	20	25	30	35	40
lbs soluble Mg/ac	80	70	60	50	40	30	20	10	0

## Sulfur

1. Apply 20 - 40 lbs S/ac to ensure that adequate sulfur is available to meet crop needs.
2. Broadcast S prior to seeding or use ammonium sulfate as an N source to supply needed S.
3. Sulfate-S is available for crop uptake immediately after application. If a reduced form of S is applied (e.g., thiosulfate or elemental S), allow adequate time for oxidation of the applied S to the sulfate form to occur.

## Manganese

Manganese (Mn) needs are predicted by an Availability Index that includes M3 soil test Mn and soil pH. Interpretation is crop specific.

$$\text{MnAI} = 101.7 - (15.2 \times \text{soil pH}) + (2.11 \times \text{M3-Mn})$$

Where:

- MnAI = Mn availability index
- Soil pH = Soil pH measured in water (1:1 V:V)
- M3-Mn = Mehlich 3 soil test Mn in lbs/ac

**Table 5. Interpretation of Mn availability index.**

Mn Availability Index	Interpretation
Less than 12	Mn deficiency is possible. Monitor the crop for symptoms
12 or greater	Mn deficiency is unlikely.

- If Mn deficiency is predicted or was observed in the previous growing season, broadcast 20-40 lbs actual Mn/ac.
- Broadcast applications of acid forming fertilizers may correct Mn deficiency without the actual application of Mn in some cases, but may be less effective than applications of Mn. Long term application of acid forming fertilizers will require pH correction with lime.
- If Mn deficiency symptoms appear during the growing season or after an application of lime, a foliar application of 0.5 to 2.0 lbs/ac actual Mn as Mn sulfate or chelated Mn can alleviate the symptoms and restore yield potential. **Apply only when adequate growth is present to aid absorption of foliar Mn.** Foliar application can be repeated if symptoms reappear.

## Zinc

Zinc (Zn) deficiency is predicted by an Availability Index that includes not only M3 soil test Zn, but also soil pH and M3 soil test P.

**Table 6. Interpretation of Zn availability index.**

Soil Test Criteria	Interpretation
M3-Zn is less than 1.9 lbs/ac	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is 6.6 or higher <b>AND</b> M3-P is 100 FIVs or higher	Zn deficiency is predicted
M3-Zn is 3.2 lbs/ac or higher	Soil should be sufficient in Zn

If zinc deficiency is predicted by the availability index or was observed the previous year, one of the following treatments can be applied:

- Broadcast 10-12 lbs/ac actual Zn as Zn sulfate or Zn oxide or 2-3 lbs/ac actual Zn as Zn chelate. Broadcast applications should correct Zn deficiency for several years.
- Foliar application of 1 lb/ac actual Zn as Zn sulfate or Zn oxide or 0.5 lb/ac actual Zn as Zn chelate in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

## **Boron**

1. Boron (B) deficiency is not usually observed in this crop. If B deficiency symptoms appear, contact your county agent for assistance with diagnosis and corrective recommendations..

### Grass / Clover Mix - New Seeding

#### Crop Highlights

- Use the correct inoculum for the legume component
- Inoculum is a live organism; use before expiration date and treat it as alive
- Select the legume and grasses to complement each other and match them for maturity date and plant height

#### Yield Goal

Yield goals are not made for new seedings of perennial forages. Instead, these recommendations are designed to promote good establishment of the forage for future productivity and discourage weed competition.

**Target pH: 6.5**

#### Recommended Liming Source:

**Table 1. Recommended type of lime as a function of soil test Ca and Mg concentrations.**

Soil Test Levels	Recommended Lime Type
Soil Test Mg less than 50 FIVs	Dolomitic
Soil Test Mg between 50 and 100 FIVs AND LESS than Soil Test Ca	Dolomitic
Soil Test Mg greater than 100 FIVs	Calcitic
Soil Test Mg GREATER than 50 FIVs AND GREATER than Soil Test Ca	Calcitic

#### Nitrogen:

1. For late summer, fall or very early spring seedings, if little weed competition is expected, apply 20 lbs N/ac at or prior to planting to encourage establishment and growth.
2. For mid- to late spring seedings, do not apply N until the grass seedlings are 2-4 inches tall to avoid stimulating weed competition. When growth reaches that height and if weed pressure is not at a competitive level, broadcast 20 - 30 lbs N/ac.
3. Nitrogen application is not recommended if the seeding mix contains legumes, however, up to 30 lbs N/ac can be applied to encourage growth without having a negative impact on nitrogen fixation.
4. Apply the appropriate inoculant and/or use inoculated seed.
5. Nitrogen application is not recommended if the available forage contains at least 25% legumes. Applied N makes the grasses more competitive and can result in the loss of legumes.
6. After each cut, evaluate forage composition. If the available forage is less than 25% legumes and soil moisture is adequate for good regrowth, apply 40 - 60 lbs N/ac per ton of expected per acre yield for the next cut (e.g., if the expected yield of the next cut is 2 tons/ac, apply 80 - 120 lbs N/ac).
7. Adjust the N application rate as expected yield changes from cut to cut, with expected weather conditions and forage composition.

## Phosphorus

**Table 2. Recommended phosphorus rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P <sub>2</sub> O <sub>5</sub> /ac	120	110	100	85	75	65	50	40	25	10	0

1. If soil test P is “Low” or “Medium” (e.g., 50 FIVs or less), broadcast and plow down the recommended rate of phosphate prior to seeding.
2. If soil test P is “Optimum” (e.g., 51 to 100 FIVs), broadcast and incorporate phosphate prior to seeding or surface broadcast at or shortly after planting.
3. If soil test P is “Excessive” (e.g., greater than 100 FIVs), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

## Potassium

**Table 3. Recommended potassium rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs K <sub>2</sub> O/ac	180	165	150	135	120	105	90	75	60	45	0

1. For new plantings using conventional tillage where applied nutrients can be worked into the top 6 to 8 inches of the soil, apply the recommended rate of potash as a broadcast application and incorporate thoroughly into the soil at or prior to seeding.
2. An additional application of 30 to 60 lbs K<sub>2</sub>O/ac broadcast over the new planting in late August or early September will help the new forage with winter survival.
3. For new plantings using no-till or minimum tillage techniques where the recommended application rate of potash is **greater than 120 lbs K<sub>2</sub>O /ac**, split the recommended rate into two treatments. Apply one-half at or prior to seeding and the remainder in late August or September.

## Magnesium

1. Magnesium (Mg) is recommended when soil test Mg is less than 38 FIVs to reduce the risk of grass tetany, especially in the spring.
2. If soil test Mg is less than 38 FIVs and lime is recommended, use dolomitic limestone.
3. If soil test Mg is less than 38 FIVs and lime is not needed, apply soluble Mg according to the rates in Table 4, below.

**Table 4. Recommended application rates of soluble magnesium as a function of soil test Mg index value.**

Soluble Mg	UD FIVs								
	0	5	10	15	20	25	30	35	40
lbs soluble Mg/ac	80	70	60	50	40	30	20	10	0

## Sulfur

1. Apply 20 - 40 lbs S/ac to ensure that adequate sulfur is available to meet crop needs.
2. Broadcast S prior to seeding or use ammonium sulfate as an N source to supply needed S.

- Sulfate-S is available for crop uptake immediately after application. If a reduced form of S is applied (e.g., thiosulfate or elemental S), allow adequate time for oxidation of the applied S to the sulfate form to occur.

## Manganese

Manganese (Mn) needs are predicted by an Availability Index that includes M3 soil test Mn and soil pH. Interpretation is crop specific.

$$\text{MnAI} = 101.7 - (15.2 \times \text{soil pH}) + (2.11 \times \text{M3-Mn})$$

Where:

- MnAI = Mn availability index  
 Soil pH = Soil pH measured in water (1:1 V:V)  
 M3-Mn = Mehlich 3 soil test Mn in lbs/ac

**Table 5. Interpretation of Mn availability index.**

Mn Availability Index	Interpretation
Less than 12	Mn deficiency is possible. Monitor the crop for symptoms
12 or greater	Mn deficiency is unlikely.

- If Mn deficiency is predicted or was observed in the previous growing season, broadcast 20-40 lbs actual Mn/ac.
- Broadcast applications of acid forming fertilizers may correct Mn deficiency without the actual application of Mn in some cases, but may be less effective than applications of Mn. Long term application of acid forming fertilizers will require pH correction with lime.
- If Mn deficiency symptoms appear during the growing season or after an application of lime, a foliar application of 0.5 to 2.0 lbs/ac actual Mn as Mn sulfate or chelated Mn can alleviate the symptoms and restore yield potential. **Apply only when adequate growth is present to aid absorption of foliar Mn.** Foliar application can be repeated if symptoms reappear.

## Zinc

Zinc (Zn) deficiency is predicted by an Availability Index that includes not only M3 soil test Zn, but also soil pH and M3 soil test P.

**Table 6. Interpretation of Zn availability index.**

Soil Test Criteria	Interpretation
M3-Zn is less than 1.9 lbs/ac	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is 6.6 or higher <b>AND</b> M3-P is 100 FIVs or higher	Zn deficiency is predicted
M3-Zn is 3.2 lbs/ac or higher	Soil should be sufficient in Zn

If zinc deficiency is predicted by the availability index or was observed the previous year, one of the following treatments can be applied:

1. Broadcast 10-12 lbs/ac actual Zn as Zn sulfate or Zn oxide or 2-3 lbs/ac actual Zn as Zn chelate. Broadcast applications should correct Zn deficiency for several years.
2. Foliar application of 1 lb/ac actual Zn as Zn sulfate or Zn oxide or 0.5 lb/ac actual Zn as Zn chelate in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

## **Boron**

1. Apply 0.5 - 1.0 lbs B/ac each year.
2. Boron (B) can be applied in a blended, broadcast fertilizer, as a soil spray or applied in a foliar spray, generally in late May or June. **Foliar applications should only be made when adequate growth is present to aid absorption of foliar B.**
3. **Caution:** Although B is required for maximum productivity of hay fields containing legumes, even slight over-application can be toxic to the crop. When applying B as a foliar spray, be certain to apply the correct rate.

### Orchardgrass - New Seeding

Crop Highlights
<ul style="list-style-type: none"> <li>• Orchardgrass grows best on soils suitable for alfalfa production.</li> <li>• Late summer seedings are preferred.</li> <li>• Do not cut or graze orchardgrass lower than 4 inches.</li> <li>• Establish and maintain adequate soil K levels to lower the risk of orchardgrass decline syndrome</li> </ul>

#### Yield Goal

Yield goals are not made for new seedings of perennial forages. Instead, these recommendations are designed to promote good establishment of the forage for future productivity and discourage weed competition.

**Target pH: 6.5**

**Recommended Liming Source:**

**Table 1. Recommended type of lime as a function of soil test Ca and Mg concentrations.**

Soil Test Levels	Recommended Lime Type
Soil Test Mg less than 50 FIVs	Dolomitic
Soil Test Mg between 50 and 100 FIVs AND LESS than Soil Test Ca	Dolomitic
Soil Test Mg greater than 100 FIVs	Calcitic
Soil Test Mg GREATER than 50 FIVs AND GREATER than Soil Test Ca	Calcitic

#### Nitrogen:

1. For late summer, fall or very early spring seedings, if little weed competition is expected, apply 20 lbs N/ac at or prior to planting.
2. For mid- to late spring seedings, do not apply N until the seedlings are 2-4 inches tall to avoid stimulating weed competition. When forage growth reaches that height and if weed pressure is not at a competitive level, broadcast 20 - 30 lbs N/ac.
3. After each cut, if soil moisture is adequate for good regrowth, apply 40 - 60 lbs N/ac per ton of expected per acre yield for the next cut (e.g., if the expected yield of the next cut is 2 tons/ac, apply 80 - 120 lbs N/ac).
4. Adjust the N application rate as expected yield changes from cut to cut and with expected weather conditions.

#### Phosphorus

**Table 2. Recommended phosphorus rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P <sub>2</sub> O <sub>5</sub> /ac	120	110	100	85	75	65	50	40	25	10	0

1. If soil test P is “Low” or “Medium” (e.g., 50 FIVs or less), broadcast and plow down the recommended rate of phosphate prior to seeding.
2. If soil test P is “Optimum” (e.g., 51 to 100 FIVs), broadcast and incorporate phosphate prior to seeding or surface broadcast at or shortly after planting.
3. If soil test P is “Excessive” (e.g., greater than 100 FIVs), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

## Potassium

**Table 3. Recommended potassium rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs K <sub>2</sub> O/ac	180	165	150	135	120	105	90	75	60	45	0

1. For new plantings using conventional tillage where applied nutrients can be worked into the top 6 to 8 inches of the soil, apply the recommended rate of potash as a broadcast application and incorporate thoroughly into the soil at or prior to seeding.
2. An additional application of 30 to 60 lbs K<sub>2</sub>O/ac broadcast over the new planting in late August or early September will help the new forage with winter survival.
3. For new plantings using no-till or minimum tillage techniques where the recommended application rate of potash is **greater than 120 lbs K<sub>2</sub>O /ac**, split the recommended rate into two treatments. Apply one-half at or prior to seeding and the remainder in late August or September.

## Magnesium

1. Magnesium (Mg) is recommended when soil test Mg is less than 38 FIVs to reduce the risk of grass tetany, especially in the spring.
2. If soil test Mg is less than 38 FIVs and lime is recommended, use dolomitic limestone.
3. If soil test Mg is less than 38 FIVs and lime is not needed, apply soluble Mg according to the rates in Table 4, below.

**Table 4. Recommended application rates of soluble magnesium as a function of soil test Mg index value.**

Soluble Mg	UD FIVs								
	0	5	10	15	20	25	30	35	40
lbs soluble Mg/ac	80	70	60	50	40	30	20	10	0

## Sulfur

1. Apply 20 - 40 lbs S/ac to ensure that adequate sulfur is available to meet crop needs.
2. Broadcast S prior to seeding or use ammonium sulfate as an N source to supply needed S.
3. Sulfate-S is available for crop uptake immediately after application. If a reduced form of S is applied (e.g., thiosulfate or elemental S), allow adequate time for oxidation of the applied S to the sulfate form to occur.

## Manganese

Manganese (Mn) needs are predicted by an Availability Index that includes M3 soil test Mn and soil pH. Interpretation is crop specific.

$$\text{MnAI} = 101.7 - (15.2 \times \text{soil pH}) + (2.11 \times \text{M3-Mn})$$

Where:

- MnAI = Mn availability index
- Soil pH = Soil pH measured in water (1:1 V:V)
- M3-Mn = Mehlich 3 soil test Mn in lbs/ac

**Table 5. Interpretation of Mn availability index.**

Mn Availability Index	Interpretation
Less than 12	Mn deficiency is possible. Monitor the crop for symptoms
12 or greater	Mn deficiency is unlikely.

- If Mn deficiency is predicted or was observed in the previous growing season, broadcast 20-40 lbs actual Mn/ac.
- Broadcast applications of acid forming fertilizers may correct Mn deficiency without the actual application of Mn in some cases, but may be less effective than applications of Mn. Long term application of acid forming fertilizers will require pH correction with lime.
- If Mn deficiency symptoms appear during the growing season or after an application of lime, a foliar application of 0.5 to 2.0 lbs/ac actual Mn as Mn sulfate or chelated Mn can alleviate the symptoms and restore yield potential. **Apply only when adequate growth is present to aid absorption of foliar Mn.** Foliar application can be repeated if symptoms reappear.

## Zinc

Zinc (Zn) deficiency is predicted by an Availability Index that includes not only M3 soil test Zn, but also soil pH and M3 soil test P.

**Table 6. Interpretation of Zn availability index.**

Soil Test Criteria	Interpretation
M3-Zn is less than 1.9 lbs/ac	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is 6.6 or higher <b>AND</b> M3-P is 100 FIVs or higher	Zn deficiency is predicted
M3-Zn is 3.2 lbs/ac or higher	Soil should be sufficient in Zn

If zinc deficiency is predicted by the availability index or was observed the previous year, one of the following treatments can be applied:

- Broadcast 10-12 lbs/ac actual Zn as Zn sulfate or Zn oxide or 2-3 lbs/ac actual Zn as Zn chelate. Broadcast applications should correct Zn deficiency for several years.
- Foliar application of 1 lb/ac actual Zn as Zn sulfate or Zn oxide or 0.5 lb/ac actual Zn as Zn chelate in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

## **Boron**

1. Boron (B) deficiency is not usually observed in this crop. If B deficiency symptoms appear, contact your county agent for assistance with diagnosis and corrective recommendations.

## Perennial Ryegrass - New Seeding

Crop Highlights
<ul style="list-style-type: none"> <li>• Where frost heaving can occur, include a legume companion crop to help</li> <li>• Excellent as no-till interseeded crop to extend the stand life of legume crops</li> <li>• Responds well to N fertilizer</li> <li>• Tetraploid cultivars are more vigorous than diploid cultivars</li> </ul>

### Yield Goal

Yield goals are not made for new seedings of perennial forages. Instead, these recommendations are designed to promote good establishment of the forage for future productivity and discourage weed competition.

**Target pH: 6.5**

**Recommended Liming Source:**

**Table 1. Recommended type of lime as a function of soil test Ca and Mg concentrations.**

Soil Test Levels	Recommended Lime Type
Soil Test Mg less than 50 FIVs	Dolomitic
Soil Test Mg between 50 and 100 FIVs AND LESS than Soil Test Ca	Dolomitic
Soil Test Mg greater than 100 FIVs	Calcitic
Soil Test Mg GREATER than 50 FIVs AND GREATER than Soil Test Ca	Calcitic

### Nitrogen:

1. For late summer, fall or very early spring seedings, if little weed competition is expected, apply 20 lbs N/ac at or prior to planting.
2. For mid- to late spring seedings, do not apply N until the seedlings are 2-4 inches tall to avoid stimulating weed competition. When forage growth reaches that height and if weed pressure is not at a competitive level, broadcast 20 - 30 lbs N/ac.
3. After each cut, if soil moisture is adequate for good regrowth, apply 40 - 60 lbs N/ac per ton of expected per acre yield for the next cut (e.g., if the expected yield of the next cut is 2 tons/ac, apply 80 - 120 lbs N/ac).
4. Adjust the N application rate as expected yield changes from cut to cut and with expected weather conditions.

### Phosphorus

**Table 2. Recommended phosphorus rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P <sub>2</sub> O <sub>5</sub> /ac	120	110	100	85	75	65	50	40	25	10	0

1. If soil test P is “Low” or “Medium” (e.g., 50 FIVs or less), broadcast and plow down the recommended rate of phosphate prior to seeding.
2. If soil test P is “Optimum” (e.g., 51 to 100 FIVs), broadcast and incorporate phosphate prior to seeding or surface broadcast at or shortly after planting.
3. If soil test P is “Excessive” (e.g., greater than 100 FIVs), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

## Potassium

**Table 3. Recommended potassium rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs K <sub>2</sub> O/ac	180	165	150	135	120	105	90	75	60	45	0

1. For new plantings using conventional tillage where applied nutrients can be worked into the top 6 to 8 inches of the soil, apply the recommended rate of potash as a broadcast application and incorporate thoroughly into the soil at or prior to seeding.
2. An additional application of 30 to 60 lbs K<sub>2</sub>O/ac broadcast over the new planting in late August or early September will help the new forage with winter survival.
3. For new plantings using no-till or minimum tillage techniques where the recommended application rate of potash is **greater than 120 lbs K<sub>2</sub>O /ac**, split the recommended rate into two treatments. Apply one-half at or prior to seeding and the remainder in late August or September.

## Magnesium

1. Magnesium (Mg) is recommended when soil test Mg is less than 38 FIVs to reduce the risk of grass tetany, especially in the spring.
2. If soil test Mg is less than 38 FIVs and lime is recommended, use dolomitic limestone.
3. If soil test Mg is less than 38 FIVs and lime is not needed, apply soluble Mg according to the rates in Table 4, below.

**Table 4. Recommended application rates of soluble magnesium as a function of soil test Mg index value.**

Soluble Mg	UD FIVs								
	0	5	10	15	20	25	30	35	40
lbs soluble Mg/ac	80	70	60	50	40	30	20	10	0

## Sulfur

1. Apply 20 - 40 lbs S/ac to ensure that adequate sulfur is available to meet crop needs.
2. Broadcast S prior to seeding or use ammonium sulfate as an N source to supply needed S.
3. Sulfate-S is available for crop uptake immediately after application. If a reduced form of S is applied (e.g., thiosulfate or elemental S), allow adequate time for oxidation of the applied S to the sulfate form to occur.

## Manganese

Manganese (Mn) needs are predicted by an Availability Index that includes M3 soil test Mn and soil pH. Interpretation is crop specific.

$$\text{MnAI} = 101.7 - (15.2 \times \text{soil pH}) + (2.11 \times \text{M3-Mn})$$

Where:

- MnAI = Mn availability index
- Soil pH = Soil pH measured in water (1:1 V:V)
- M3-Mn = Mehlich 3 soil test Mn in lbs/ac

**Table 5. Interpretation of Mn availability index.**

Mn Availability Index	Interpretation
Less than 12	Mn deficiency is possible. Monitor the crop for symptoms
12 or greater	Mn deficiency is unlikely.

1. If Mn deficiency is predicted or was observed in the previous growing season, broadcast 20-40 lbs actual Mn/ac.
2. Broadcast applications of acid forming fertilizers may correct Mn deficiency without the actual application of Mn in some cases, but may be less effective than applications of Mn. Long term application of acid forming fertilizers will require pH correction with lime.
3. If Mn deficiency symptoms appear during the growing season or after an application of lime, a foliar application of 0.5 to 2.0 lbs/ac actual Mn as Mn sulfate or chelated Mn can alleviate the symptoms and restore yield potential. **Apply only when adequate growth is present to aid absorption of foliar Mn.** Foliar application can be repeated if symptoms reappear.

## Zinc

Zinc (Zn) deficiency is predicted by an Availability Index that includes not only M3 soil test Zn, but also soil pH and M3 soil test P.

**Table 6. Interpretation of Zn availability index.**

Soil Test Criteria	Interpretation
M3-Zn is less than 1.9 lbs/ac	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is 6.6 or higher <b>AND</b> M3-P is 100 FIVs or higher	Zn deficiency is predicted
M3-Zn is 3.2 lbs/ac or higher	Soil should be sufficient in Zn

If zinc deficiency is predicted by the availability index or was observed the previous year, one of the following treatments can be applied:

1. Broadcast 10-12 lbs/ac actual Zn as Zn sulfate or Zn oxide or 2-3 lbs/ac actual Zn as Zn chelate. Broadcast applications should correct Zn deficiency for several years.
2. Foliar application of 1 lb/ac actual Zn as Zn sulfate or Zn oxide or 0.5 lb/ac actual Zn as Zn chelate in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

## **Boron**

1. Boron (B) deficiency is not usually observed in this crop. If B deficiency symptoms appear, contact your county agent for assistance with diagnosis and corrective recommendations.

## Red Clover - New Seeding

Crop Highlights
<ul style="list-style-type: none"> <li>• Best yield/grazing gains come if seeded with an accompanying forage grass</li> <li>• Has more limited success when frost-cracked seeded than white clover</li> <li>• Older cultivars survive only 1.5 to 2 years as stands thin</li> <li>• Rotate to new field since disease pressure builds with time</li> </ul>

### Yield Goal

Yield goals are not made for new seedings of perennial forages. Instead, these recommendations are designed to promote good establishment of the forage for future productivity and discourage weed competition.

**Target pH: 6.5**

**Recommended Liming Source:**

**Table 1. Recommended type of lime as a function of soil test Ca and Mg concentrations.**

Soil Test Levels	Recommended Lime Type
Soil Test Mg less than 50 FIVs	Dolomitic
Soil Test Mg between 50 and 100 FIVs AND LESS than Soil Test Ca	Dolomitic
Soil Test Mg greater than 100 FIVs	Calcitic
Soil Test Mg GREATER than 50 FIVs AND GREATER than Soil Test Ca	Calcitic

### Nitrogen:

1. Nitrogen (N) application is not recommended for legumes, however, up to 30 lbs N/ac can be applied to encourage growth without having a negative impact on nitrogen fixation.
2. Apply the appropriate inoculant and/or use inoculated seed.
3. If nodulation failure occurs, you may need to apply N to support crop growth until nodulation takes place. Contact your county agent for further assistance.

### Phosphorus

**Table 2. Recommended phosphorus rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P <sub>2</sub> O <sub>5</sub> /ac	120	110	100	85	75	65	50	40	25	10	0

1. If soil test P is “Low” or “Medium” (e.g., 50 FIVs or less), broadcast and plow down the recommended rate of phosphate prior to seeding.
2. If soil test P is “Optimum” (e.g., 51 to 100 FIVs), broadcast and incorporate phosphate prior to seeding or surface broadcast at or shortly after planting.

- If soil test P is “Excessive” (e.g., greater than 100 FIVs), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

## Potassium

**Table 3. Recommended potassium rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs K <sub>2</sub> O/ac	180	165	150	135	120	105	90	75	60	45	0

- For new plantings using conventional tillage where applied nutrients can be worked into the top 6 to 8 inches of the soil, apply the recommended rate of potash as a broadcast application and incorporate thoroughly into the soil at or prior to seeding.
- An additional application of 30 to 60 lbs K<sub>2</sub>O/ac broadcast over the new planting in late August or early September will help the new forage with winter survival.
- For new plantings using no-till or minimum tillage techniques where the recommended application rate of potash is **greater than 120 lbs K<sub>2</sub>O /ac**, split the recommended rate into two treatments. Apply one-half at or prior to seeding and the remainder in late August or September.

## Magnesium

- Magnesium (Mg) is recommended when soil test Mg is less than 38 FIVs to reduce the risk of grass tetany, especially in the spring.
- If soil test Mg is less than 38 FIVs and lime is recommended, use dolomitic limestone.
- If soil test Mg is less than 38 FIVs and lime is not needed, apply soluble Mg according to the rates in Table 4, below.

**Table 4. Recommended application rates of soluble magnesium as a function of soil test Mg index value.**

Soluble Mg	UD FIVs								
	0	5	10	15	20	25	30	35	40
lbs soluble Mg/ac	80	70	60	50	40	30	20	10	0

## Sulfur

- Apply 20 - 40 lbs S/ac to ensure that adequate sulfur is available to meet crop needs.
- Broadcast S prior to seeding.
- Sulfate-S is available for crop uptake immediately after application. If a reduced form of S is applied (e.g., thiosulfate or elemental S), allow adequate time for oxidation of the applied S to the sulfate form to occur.

## Manganese

Manganese (Mn) needs are predicted by an Availability Index that includes M3 soil test Mn and soil pH. Interpretation is crop specific.

$$\text{MnAI} = 101.7 - (15.2 \times \text{soil pH}) + (2.11 \times \text{M3-Mn})$$

Where:

- MnAI = Mn availability index  
Soil pH = Soil pH measured in water (1:1 V:V)  
M3-Mn = Mehlich 3 soil test Mn in lbs/ac

**Table 5. Interpretation of Mn availability index.**

Mn Availability Index	Interpretation
Less than 12	Mn deficiency is possible. Monitor the crop for symptoms
12 or greater	Mn deficiency is unlikely.

1. If Mn deficiency is predicted or was observed in the previous growing season, broadcast 20-40 lbs actual Mn/ac.
2. Broadcast applications of acid forming fertilizers may correct Mn deficiency without the actual application of Mn in some cases, but may be less effective than applications of Mn. Long term application of acid forming fertilizers will require pH correction with lime.
3. If Mn deficiency symptoms appear during the growing season or after an application of lime, a foliar application of 0.5 to 2.0 lbs/ac actual Mn as Mn sulfate or chelated Mn can alleviate the symptoms and restore yield potential. **Apply only when adequate growth is present to aid absorption of foliar Mn.** Foliar application can be repeated if symptoms reappear.

## Zinc

Zinc (Zn) deficiency is predicted by an Availability Index that includes not only M3 soil test Zn, but also soil pH and M3 soil test P.

**Table 6. Interpretation of Zn availability index.**

Soil Test Criteria	Interpretation
M3-Zn is less than 1.9 lbs/ac	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is 6.6 or higher <b>AND</b> M3-P is 100 FIVs or higher	Zn deficiency is predicted
M3-Zn is 3.2 lbs/ac or higher	Soil should be sufficient in Zn

If zinc deficiency is predicted by the availability index or was observed the previous year, one of the following treatments can be applied:

1. Broadcast 10-12 lbs/ac actual Zn as Zn sulfate or Zn oxide or 2-3 lbs/ac actual Zn as Zn chelate. Broadcast applications should correct Zn deficiency for several years.
2. Foliar application of 1 lb/ac actual Zn as Zn sulfate or Zn oxide or 0.5 lb/ac actual Zn as Zn chelate in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

## Boron

1. Apply 1.0 - 2.0 lbs B/ac each year.

2. Boron (B) can be applied in a blended, broadcast fertilizer, as a soil spray or applied in a foliar spray, generally in late May or June. ***Foliar applications should only be made when adequate growth is present to aid absorption of foliar B.***
3. **Caution:** Although B is required for maximum productivity of hay fields containing legumes, even slight over-application can be toxic to the crop. When applying B as a foliar spray, be certain to apply the correct rate.

## Reed Canarygrass - New Seeding

### Crop Highlights

- Only seed in late-summer before about Sept. 10
- Reed canarygrass needs six week frost-free period to survive winter
- Initially growth is very slow so plant into weed-free seedbed
- Seed viability declines rapidly due to high oil content in seed
- Seed is usually very expensive if even available
- Plant low alkaloid cultivars for most animal species

### Yield Goal

Yield goals are not made for new seedings of perennial forages. Instead, these recommendations are designed to promote good establishment of the forage for future productivity and discourage weed competition.

**Target pH: 6.5**

**Recommended Liming Source:**

**Table 1. Recommended type of lime as a function of soil test Ca and Mg concentrations.**

Soil Test Levels	Recommended Lime Type
Soil Test Mg less than 50 FIVs	Dolomitic
Soil Test Mg between 50 and 100 FIVs AND LESS than Soil Test Ca	Dolomitic
Soil Test Mg greater than 100 FIVs	Calcitic
Soil Test Mg GREATER than 50 FIVs AND GREATER than Soil Test Ca	Calcitic

### Nitrogen:

1. For late summer, fall or very early spring seedings, if little weed competition is expected, apply 20 lbs N/ac at or prior to planting.
2. For mid- to late spring seedings, do not apply N until the seedlings are 2-4 inches tall to avoid stimulating weed competition. When forage growth reaches that height and if weed pressure is not at a competitive level, broadcast 20 - 30 lbs N/ac.
3. After each cut, if soil moisture is adequate for good regrowth, apply 40 - 60 lbs N/ac per ton of expected per acre yield for the next cut (e.g., if the expected yield of the next cut is 2 tons/ac, apply 80 - 120 lbs N/ac).
4. Adjust the N application rate as expected yield changes from cut to cut and with expected weather conditions.

## Phosphorus

**Table 2. Recommended phosphorus rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P <sub>2</sub> O <sub>5</sub> /ac	120	110	100	85	75	65	50	40	25	10	0

1. If soil test P is “Low” or “Medium” (e.g., 50 FIVs or less), broadcast and plow down the recommended rate of phosphate prior to seeding.
2. If soil test P is “Optimum” (e.g., 51 to 100 FIVs), broadcast and incorporate phosphate prior to seeding or surface broadcast at or shortly after planting.
3. If soil test P is “Excessive” (e.g., greater than 100 FIVs), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

## Potassium

**Table 3. Recommended potassium rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs K <sub>2</sub> O/ac	180	165	150	135	120	105	90	75	60	45	0

1. For new plantings using conventional tillage where applied nutrients can be worked into the top 6 to 8 inches of the soil, apply the recommended rate of potash as a broadcast application and incorporate thoroughly into the soil at or prior to seeding.
2. An additional application of 30 to 60 lbs K<sub>2</sub>O/ac broadcast over the new planting in late August or early September will help the new forage with winter survival.
3. For new plantings using no-till or minimum tillage techniques where the recommended application rate of potash is **greater than 120 lbs K<sub>2</sub>O /ac**, split the recommended rate into two treatments. Apply one-half at or prior to seeding and the remainder in late August or September.

## Magnesium

1. Magnesium (Mg) is recommended when soil test Mg is less than 38 FIVs to reduce the risk of grass tetany, especially in the spring.
2. If soil test Mg is less than 38 FIVs and lime is recommended, use dolomitic limestone.
3. If soil test Mg is less than 38 FIVs and lime is not needed, apply soluble Mg according to the rates in Table 4, below.

**Table 4. Recommended application rates of soluble magnesium as a function of soil test Mg index value.**

Soluble Mg	UD FIVs								
	0	5	10	15	20	25	30	35	40
lbs soluble Mg/ac	80	70	60	50	40	30	20	10	0

## Sulfur

1. Apply 20 - 40 lbs S/ac to ensure that adequate sulfur is available to meet crop needs.
2. Broadcast S prior to seeding or use ammonium sulfate as an N source to supply needed S.

- Sulfate-S is available for crop uptake immediately after application. If a reduced form of S is applied (e.g., thiosulfate or elemental S), allow adequate time for oxidation of the applied S to the sulfate form to occur.

## Manganese

Manganese (Mn) needs are predicted by an Availability Index that includes M3 soil test Mn and soil pH. Interpretation is crop specific.

$$\text{MnAI} = 101.7 - (15.2 \times \text{soil pH}) + (2.11 \times \text{M3-Mn})$$

Where:

- MnAI = Mn availability index  
 Soil pH = Soil pH measured in water (1:1 V:V)  
 M3-Mn = Mehlich 3 soil test Mn in lbs/ac

**Table 5. Interpretation of Mn availability index.**

Mn Availability Index	Interpretation
Less than 12	Mn deficiency is possible. Monitor the crop for symptoms
12 or greater	Mn deficiency is unlikely.

- If Mn deficiency is predicted or was observed in the previous growing season, broadcast 20-40 lbs actual Mn/ac.
- Broadcast applications of acid forming fertilizers may correct Mn deficiency without the actual application of Mn in some cases, but may be less effective than applications of Mn. Long term application of acid forming fertilizers will require pH correction with lime.
- If Mn deficiency symptoms appear during the growing season or after an application of lime, a foliar application of 0.5 to 2.0 lbs/ac actual Mn as Mn sulfate or chelated Mn can alleviate the symptoms and restore yield potential. **Apply only when adequate growth is present to aid absorption of foliar Mn.** Foliar application can be repeated if symptoms reappear.

## Zinc

Zinc (Zn) deficiency is predicted by an Availability Index that includes not only M3 soil test Zn, but also soil pH and M3 soil test P.

**Table 6. Interpretation of Zn availability index.**

Soil Test Criteria	Interpretation
M3-Zn is less than 1.9 lbs/ac	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is 6.6 or higher <b>AND</b> M3-P is 100 FIVs or higher	Zn deficiency is predicted
M3-Zn is 3.2 lbs/ac or higher	Soil should be sufficient in Zn

If zinc deficiency is predicted by the availability index or was observed the previous year, one of the following treatments can be applied:

1. Broadcast 10-12 lbs/ac actual Zn as Zn sulfate or Zn oxide or 2-3 lbs/ac actual Zn as Zn chelate. Broadcast applications should correct Zn deficiency for several years.
2. Foliar application of 1 lb/ac actual Zn as Zn sulfate or Zn oxide or 0.5 lb/ac actual Zn as Zn chelate in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

## **Boron**

1. Boron (B) deficiency is not usually observed in this crop. If B deficiency symptoms appear, contact your county agent for assistance with diagnosis and corrective recommendations.

## Smooth Bromegrass - New Seeding

Crop Highlights
<ul style="list-style-type: none"> <li>• Light chaffy seed can complicate seeding; check often for seed bridging in seed box</li> <li>• Avoid planting seed too deep</li> <li>• Only appropriate in northern portion of state on better soils</li> </ul>

### Yield Goal

Yield goals are not made for new seedings of perennial forages. Instead, these recommendations are designed to promote good establishment of the forage for future productivity and discourage weed competition.

**Target pH: 6.5**

**Recommended Liming Source:**

**Table 1. Recommended type of lime as a function of soil test Ca and Mg concentrations.**

Soil Test Levels	Recommended Lime Type
Soil Test Mg less than 50 FIVs	Dolomitic
Soil Test Mg between 50 and 100 FIVs AND LESS than Soil Test Ca	Dolomitic
Soil Test Mg greater than 100 FIVs	Calcitic
Soil Test Mg GREATER than 50 FIVs AND GREATER than Soil Test Ca	Calcitic

### Nitrogen:

1. For late summer, fall or very early spring seedings, if little weed competition is expected, apply 20 lbs N/ac at or prior to planting.
2. For mid- to late spring seedings, do not apply N until the seedlings are 2-4 inches tall to avoid stimulating weed competition. When forage growth reaches that height and if weed pressure is not at a competitive level, broadcast 20 - 30 lbs N/ac.
3. After each cut, if soil moisture is adequate for good regrowth, apply 40 - 60 lbs N/ac per ton of expected per acre yield for the next cut (e.g., if the expected yield of the next cut is 2 tons/ac, apply 80 - 120 lbs N/ac).
4. Adjust the N application rate as expected yield changes from cut to cut and with expected weather conditions.

### Phosphorus

**Table 2. Recommended phosphorus rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P <sub>2</sub> O <sub>5</sub> /ac	120	110	100	85	75	65	50	40	25	10	0

1. If soil test P is “Low” or “Medium” (e.g., 50 FIVs or less), broadcast and plow down the recommended rate of phosphate prior to seeding.
2. If soil test P is “Optimum” (e.g., 51 to 100 FIVs), broadcast and incorporate phosphate prior to seeding or surface broadcast at or shortly after planting.
3. If soil test P is “Excessive” (e.g., greater than 100 FIVs), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

## Potassium

**Table 3. Recommended potassium rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs K <sub>2</sub> O/ac	180	165	150	135	120	105	90	75	60	45	0

1. For new plantings using conventional tillage where applied nutrients can be worked into the top 6 to 8 inches of the soil, apply the recommended rate of potash as a broadcast application and incorporate thoroughly into the soil at or prior to seeding.
2. An additional application of 30 to 60 lbs K<sub>2</sub>O/ac broadcast over the new planting in late August or early September will help the new forage with winter survival.
3. For new plantings using no-till or minimum tillage techniques where the recommended application rate of potash is **greater than 120 lbs K<sub>2</sub>O /ac**, split the recommended rate into two treatments. Apply one-half at or prior to seeding and the remainder in late August or September.

## Magnesium

1. Magnesium (Mg) is recommended when soil test Mg is less than 38 FIVs to reduce the risk of grass tetany, especially in the spring.
2. If soil test Mg is less than 38 FIVs and lime is recommended, use dolomitic limestone.
3. If soil test Mg is less than 38 FIVs and lime is not needed, apply soluble Mg according to the rates in Table 4, below.

**Table 4. Recommended application rates of soluble magnesium as a function of soil test Mg index value.**

Soluble Mg	UD FIVs								
	0	5	10	15	20	25	30	35	40
lbs soluble Mg/ac	80	70	60	50	40	30	20	10	0

## Sulfur

1. Apply 20 - 40 lbs S/ac to ensure that adequate sulfur is available to meet crop needs.
2. Broadcast S prior to seeding or use ammonium sulfate as an N source to supply needed S.
3. Sulfate-S is available for crop uptake immediately after application. If a reduced form of S is applied (e.g., thiosulfate or elemental S), allow adequate time for oxidation of the applied S to the sulfate form to occur.

## Manganese

Manganese (Mn) needs are predicted by an Availability Index that includes M3 soil test Mn and soil pH. Interpretation is crop specific.

$$\text{MnAI} = 101.7 - (15.2 \times \text{soil pH}) + (2.11 \times \text{M3-Mn})$$

Where:

- MnAI = Mn availability index
- Soil pH = Soil pH measured in water (1:1 V:V)
- M3-Mn = Mehlich 3 soil test Mn in lbs/ac

**Table 5. Interpretation of Mn availability index.**

Mn Availability Index	Interpretation
Less than 12	Mn deficiency is possible. Monitor the crop for symptoms
12 or greater	Mn deficiency is unlikely.

- If Mn deficiency is predicted or was observed in the previous growing season, broadcast 20-40 lbs actual Mn/ac.
- Broadcast applications of acid forming fertilizers may correct Mn deficiency without the actual application of Mn in some cases, but may be less effective than applications of Mn. Long term application of acid forming fertilizers will require pH correction with lime.
- If Mn deficiency symptoms appear during the growing season or after an application of lime, a foliar application of 0.5 to 2.0 lbs/ac actual Mn as Mn sulfate or chelated Mn can alleviate the symptoms and restore yield potential. **Apply only when adequate growth is present to aid absorption of foliar Mn.** Foliar application can be repeated if symptoms reappear.

## Zinc

Zinc (Zn) deficiency is predicted by an Availability Index that includes not only M3 soil test Zn, but also soil pH and M3 soil test P.

**Table 6. Interpretation of Zn availability index.**

Soil Test Criteria	Interpretation
M3-Zn is less than 1.9 lbs/ac	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is 6.6 or higher <b>AND</b> M3-P is 100 FIVs or higher	Zn deficiency is predicted
M3-Zn is 3.2 lbs/ac or higher	Soil should be sufficient in Zn

If zinc deficiency is predicted by the availability index or was observed the previous year, one of the following treatments can be applied:

- Broadcast 10-12 lbs/ac actual Zn as Zn sulfate or Zn oxide or 2-3 lbs/ac actual Zn as Zn chelate. Broadcast applications should correct Zn deficiency for several years.
- Foliar application of 1 lb/ac actual Zn as Zn sulfate or Zn oxide or 0.5 lb/ac actual Zn as Zn chelate in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

## **Boron**

1. Boron (B) deficiency is not usually observed in this crop. If B deficiency symptoms appear, contact your county agent for assistance with diagnosis and corrective recommendations.

### Tall Fescue - New Seeding

#### Crop Highlights

- Use the novel or friendly endophyte cultivars for best stand life and improved performance
- Soft-leaved cultivars are available and may improve fescue palatability
- If fall planted, take the first harvest the following spring as hay, allow to regrow before grazing if pasture
- Best stand life and productivity occur if allowed to establish for 12 to 18 months before grazing

#### Yield Goal

Yield goals are not made for new seedings of perennial forages. Instead, these recommendations are designed to promote good establishment of the forage for future productivity and discourage weed competition.

**Target pH: 6.5**

**Recommended Liming Source:**

**Table 1. Recommended type of lime as a function of soil test Ca and Mg concentrations.**

Soil Test Levels	Recommended Lime Type
Soil Test Mg less than 50 FIVs	Dolomitic
Soil Test Mg between 50 and 100 FIVs AND LESS than Soil Test Ca	Dolomitic
Soil Test Mg greater than 100 FIVs	Calcitic
Soil Test Mg GREATER than 50 FIVs AND GREATER than Soil Test Ca	Calcitic

#### Nitrogen:

1. For late summer, fall or very early spring seedings, if little weed competition is expected, apply 20 lbs N/ac at or prior to planting.
2. For mid- to late spring seedings, do not apply N until the seedlings are 2-4 inches tall to avoid stimulating weed competition. When forage growth reaches that height and if weed pressure is not at a competitive level, broadcast 20 - 30 lbs N/ac..
3. After each cut, if soil moisture is adequate for good regrowth, apply 40 - 60 lbs N/ac per ton of expected per acre yield for the next cut (e.g., if the expected yield of the next cut is 2 tons/ac, apply 80 - 120 lbs N/ac).
4. Adjust the N application rate as expected yield changes from cut to cut and with expected weather conditions.

## Phosphorus

**Table 2. Recommended phosphorus rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P <sub>2</sub> O <sub>5</sub> /ac	120	110	100	85	75	65	50	40	25	10	0

1. If soil test P is “Low” or “Medium” (e.g., 50 FIVs or less), broadcast and plow down the recommended rate of phosphate prior to seeding.
2. If soil test P is “Optimum” (e.g., 51 to 100 FIVs), broadcast and incorporate phosphate prior to seeding or surface broadcast at or shortly after planting.
3. If soil test P is “Excessive” (e.g., greater than 100 FIVs), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

## Potassium

**Table 3. Recommended potassium rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs K <sub>2</sub> O/ac	180	165	150	135	120	105	90	75	60	45	0

1. For new plantings using conventional tillage where applied nutrients can be worked into the top 6 to 8 inches of the soil, apply the recommended rate of potash as a broadcast application and incorporate thoroughly into the soil at or prior to seeding.
2. An additional application of 30 to 60 lbs K<sub>2</sub>O/ac broadcast over the new planting in late August or early September will help the new forage with winter survival.
3. For new plantings using no-till or minimum tillage techniques where the recommended application rate of potash is **greater than 120 lbs K<sub>2</sub>O /ac**, split the recommended rate into two treatments. Apply one-half at or prior to seeding and the remainder in late August or September.

## Magnesium

1. Magnesium (Mg) is recommended when soil test Mg is less than 38 FIVs to reduce the risk of grass tetany, especially in the spring.
2. If soil test Mg is less than 38 FIVs and lime is recommended, use dolomitic limestone.
3. If soil test Mg is less than 38 FIVs and lime is not needed, apply soluble Mg according to the rates in Table 4, below.

**Table 4. Recommended application rates of soluble magnesium as a function of soil test Mg index value.**

Soluble Mg	UD FIVs								
	0	5	10	15	20	25	30	35	40
lbs soluble Mg/ac	80	70	60	50	40	30	20	10	0

## Sulfur

1. Apply 20 - 40 lbs S/ac to ensure that adequate sulfur is available to meet crop needs.
2. Broadcast S prior to seeding or use ammonium sulfate as an N source to supply needed S.

- Sulfate-S is available for crop uptake immediately after application. If a reduced form of S is applied (e.g., thiosulfate or elemental S), allow adequate time for oxidation of the applied S to the sulfate form to occur.

## Manganese

Manganese (Mn) needs are predicted by an Availability Index that includes M3 soil test Mn and soil pH. Interpretation is crop specific.

$$\text{MnAI} = 101.7 - (15.2 \times \text{soil pH}) + (2.11 \times \text{M3-Mn})$$

Where:

- MnAI = Mn availability index  
 Soil pH = Soil pH measured in water (1:1 V:V)  
 M3-Mn = Mehlich 3 soil test Mn in lbs/ac

**Table 5. Interpretation of Mn availability index.**

Mn Availability Index	Interpretation
Less than 12	Mn deficiency is possible. Monitor the crop for symptoms
12 or greater	Mn deficiency is unlikely.

- If Mn deficiency is predicted or was observed in the previous growing season, broadcast 20-40 lbs actual Mn/ac.
- Broadcast applications of acid forming fertilizers may correct Mn deficiency without the actual application of Mn in some cases, but may be less effective than applications of Mn. Long term application of acid forming fertilizers will require pH correction with lime.
- If Mn deficiency symptoms appear during the growing season or after an application of lime, a foliar application of 0.5 to 2.0 lbs/ac actual Mn as Mn sulfate or chelated Mn can alleviate the symptoms and restore yield potential. **Apply only when adequate growth is present to aid absorption of foliar Mn.** Foliar application can be repeated if symptoms reappear.

## Zinc

Zinc (Zn) deficiency is predicted by an Availability Index that includes not only M3 soil test Zn, but also soil pH and M3 soil test P.

**Table 6. Interpretation of Zn availability index.**

Soil Test Criteria	Interpretation
M3-Zn is less than 1.9 lbs/ac	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is 6.6 or higher <b>AND</b> M3-P is 100 FIVs or higher	Zn deficiency is predicted
M3-Zn is 3.2 lbs/ac or higher	Soil should be sufficient in Zn

If zinc deficiency is predicted by the availability index or was observed the previous year, one of the following treatments can be applied:

1. Broadcast 10-12 lbs/ac actual Zn as Zn sulfate or Zn oxide or 2-3 lbs/ac actual Zn as Zn chelate. Broadcast applications should correct Zn deficiency for several years.
2. Foliar application of 1 lb/ac actual Zn as Zn sulfate or Zn oxide or 0.5 lb/ac actual Zn as Zn chelate in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

## **Boron**

1. Boron (B) deficiency is not usually observed in this crop. If B deficiency symptoms appear, contact your county agent for assistance with diagnosis and corrective recommendations.

### Timothy - New Seeding

#### Crop Highlights

- Small seeds, easy to plant too deep
- If field has a history of cereal rust mites, rotate out of timothy for several years
- The crop seems to be very site specific with respect to performance

#### Yield Goal

Yield goals are not made for new seedings of perennial forages. Instead, these recommendations are designed to promote good establishment of the forage for future productivity and discourage weed competition.

**Target pH: 6.5**

**Recommended Liming Source:**

**Table 1. Recommended type of lime as a function of soil test Ca and Mg concentrations.**

Soil Test Levels	Recommended Lime Type
Soil Test Mg less than 50 FIVs	Dolomitic
Soil Test Mg between 50 and 100 FIVs AND LESS than Soil Test Ca	Dolomitic
Soil Test Mg greater than 100 FIVs	Calcitic
Soil Test Mg GREATER than 50 FIVs AND GREATER than Soil Test Ca	Calcitic

#### Nitrogen:

1. For late summer, fall or very early spring seedings, if little weed competition is expected, apply 20 lbs N/ac at or prior to planting.
2. For mid- to late spring seedings, do not apply N until the seedlings are 2-4 inches tall to avoid stimulating weed competition. When forage growth reaches that height and if weed pressure is not at a competitive level, broadcast 20 - 30 lbs N/ac.
3. After each cut, if soil moisture is adequate for good regrowth, apply 40 - 60 lbs N/ac per ton of expected per acre yield for the next cut (e.g., if the expected yield of the next cut is 2 tons/ac, apply 80 - 120 lbs N/ac).
4. Adjust the N application rate as expected yield changes from cut to cut and with expected weather conditions.

#### Phosphorus

**Table 2. Recommended phosphorus rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P <sub>2</sub> O <sub>5</sub> /ac	120	110	100	85	75	65	50	40	25	10	0

1. If soil test P is “Low” or “Medium” (e.g., 50 FIVs or less), broadcast and plow down the recommended rate of phosphate prior to seeding.
2. If soil test P is “Optimum” (e.g., 51 to 100 FIVs), broadcast and incorporate phosphate prior to seeding or surface broadcast at or shortly after planting.
3. If soil test P is “Excessive” (e.g., greater than 100 FIVs), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

## Potassium

**Table 3. Recommended potassium rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs K <sub>2</sub> O/ac	180	165	150	135	120	105	90	75	60	45	0

1. For new plantings using conventional tillage where applied nutrients can be worked into the top 6 to 8 inches of the soil, apply the recommended rate of potash as a broadcast application and incorporate thoroughly into the soil at or prior to seeding.
2. An additional application of 30 to 60 lbs K<sub>2</sub>O/ac broadcast over the new planting in late August or early September will help the new forage with winter survival.
3. For new plantings using no-till or minimum tillage techniques where the recommended application rate of potash is **greater than 120 lbs K<sub>2</sub>O /ac**, split the recommended rate into two treatments. Apply one-half at or prior to seeding and the remainder in late August or September.

## Magnesium

1. Magnesium (Mg) is recommended when soil test Mg is less than 38 FIVs to reduce the risk of grass tetany, especially in the spring.
2. If soil test Mg is less than 38 FIVs and lime is recommended, use dolomitic limestone.
3. If soil test Mg is less than 38 FIVs and lime is not needed, apply soluble Mg according to the rates in Table 4, below.

**Table 4. Recommended application rates of soluble magnesium as a function of soil test Mg index value.**

Soluble Mg	UD FIVs								
	0	5	10	15	20	25	30	35	40
lbs soluble Mg/ac	80	70	60	50	40	30	20	10	0

## Sulfur

1. Apply 20 - 40 lbs S/ac to ensure that adequate sulfur is available to meet crop needs.
2. Broadcast S prior to seeding or use ammonium sulfate as an N source to supply needed S.
3. Sulfate-S is available for crop uptake immediately after application. If a reduced form of S is applied (e.g., thiosulfate or elemental S), allow adequate time for oxidation of the applied S to the sulfate form to occur.

## Manganese

Manganese (Mn) needs are predicted by an Availability Index that includes M3 soil test Mn and soil pH. Interpretation is crop specific.

$$\text{MnAI} = 101.7 - (15.2 \times \text{soil pH}) + (2.11 \times \text{M3-Mn})$$

Where:

- MnAI = Mn availability index
- Soil pH = Soil pH measured in water (1:1 V:V)
- M3-Mn = Mehlich 3 soil test Mn in lbs/ac

**Table 5. Interpretation of Mn availability index.**

Mn Availability Index	Interpretation
Less than 12	Mn deficiency is possible. Monitor the crop for symptoms
12 or greater	Mn deficiency is unlikely.

- If Mn deficiency is predicted or was observed in the previous growing season, broadcast 20-40 lbs actual Mn/ac.
- Broadcast applications of acid forming fertilizers may correct Mn deficiency without the actual application of Mn in some cases, but may be less effective than applications of Mn. Long term application of acid forming fertilizers will require pH correction with lime.
- If Mn deficiency symptoms appear during the growing season or after an application of lime, a foliar application of 0.5 to 2.0 lbs/ac actual Mn as Mn sulfate or chelated Mn can alleviate the symptoms and restore yield potential. **Apply only when adequate growth is present to aid absorption of foliar Mn.** Foliar application can be repeated if symptoms reappear.

## Zinc

Zinc (Zn) deficiency is predicted by an Availability Index that includes not only M3 soil test Zn, but also soil pH and M3 soil test P.

**Table 6. Interpretation of Zn availability index.**

Soil Test Criteria	Interpretation
M3-Zn is less than 1.9 lbs/ac	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is 6.6 or higher <b>AND</b> M3-P is 100 FIVs or higher	Zn deficiency is predicted
M3-Zn is 3.2 lbs/ac or higher	Soil should be sufficient in Zn

If zinc deficiency is predicted by the availability index or was observed the previous year, one of the following treatments can be applied:

- Broadcast 10-12 lbs/ac actual Zn as Zn sulfate or Zn oxide or 2-3 lbs/ac actual Zn as Zn chelate. Broadcast applications should correct Zn deficiency for several years.
- Foliar application of 1 lb/ac actual Zn as Zn sulfate or Zn oxide or 0.5 lb/ac actual Zn as Zn chelate in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

## **Boron**

1. Boron (B) deficiency is not usually observed in this crop. If B deficiency symptoms appear, contact your county agent for assistance with diagnosis and corrective recommendations..

### White Clover - New Seeding

Crop Highlights
<ul style="list-style-type: none"> <li>• Best yield and animal performance comes if seeded with an accompanying forage grass</li> <li>• Very small seeds so avoid seeding too deep</li> <li>• Excellent for use in frost-crack seedings in late-winter or early-spring</li> </ul>

#### Yield Goal

Yield goals are not made for new seedings of perennial forages. Instead, these recommendations are designed to promote good establishment of the forage for future productivity and discourage weed competition.

**Target pH: 6.5**

**Recommended Liming Source:**

**Table 1. Recommended type of lime as a function of soil test Ca and Mg concentrations.**

Soil Test Levels	Recommended Lime Type
Soil Test Mg less than 50 FIVs	Dolomitic
Soil Test Mg between 50 and 100 FIVs AND LESS than Soil Test Ca	Dolomitic
Soil Test Mg greater than 100 FIVs	Calcitic
Soil Test Mg GREATER than 50 FIVs AND GREATER than Soil Test Ca	Calcitic

#### Nitrogen:

1. Nitrogen (N) application is not recommended for legumes, however, up to 30 lbs N/ac can be applied to encourage growth without having a negative impact on nitrogen fixation.
2. Apply the appropriate inoculant and/or use inoculated seed.
3. If nodulation failure occurs, you may need to apply N to support crop growth until nodulation takes place. Contact your county agent for further assistance.

#### Phosphorus

**Table 2. Recommended phosphorus rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P <sub>2</sub> O <sub>5</sub> /ac	120	110	100	85	75	65	50	40	25	10	0

1. If soil test P is “Low” or “Medium” (e.g., 50 FIVs or less), broadcast and plow down the recommended rate of phosphate prior to seeding.
2. If soil test P is “Optimum” (e.g., 51 to 100 FIVs), broadcast and incorporate phosphate prior to seeding or surface broadcast at or shortly after planting.

- If soil test P is “Excessive” (e.g., greater than 100 FIVs), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

## Potassium

**Table 3. Recommended potassium rate to reach optimal soil test levels to support good forage establishment and future productivity.**

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs K <sub>2</sub> O/ac	180	165	150	135	120	105	90	75	60	45	0

- For new plantings using conventional tillage where applied nutrients can be worked into the top 6 to 8 inches of the soil, apply the recommended rate of potash as a broadcast application and incorporate thoroughly into the soil at or prior to seeding.
- An additional application of 30 to 60 lbs K<sub>2</sub>O/ac broadcast over the new planting in late August or early September will help the new forage with winter survival.
- For new plantings using no-till or minimum tillage techniques where the recommended application rate of potash is **greater than 120 lbs K<sub>2</sub>O /ac**, split the recommended rate into two treatments. Apply one-half at or prior to seeding and the remainder in late August or September.

## Magnesium

- Magnesium (Mg) is recommended when soil test Mg is less than 38 FIVs to reduce the risk of grass tetany, especially in the spring.
- If soil test Mg is less than 38 FIVs and lime is recommended, use dolomitic limestone.
- If soil test Mg is less than 38 FIVs and lime is not needed, apply soluble Mg according to the rates in Table 4, below.

**Table 4. Recommended application rates of soluble magnesium as a function of soil test Mg index value.**

Soluble Mg	UD FIVs								
	0	5	10	15	20	25	30	35	40
lbs soluble Mg/ac	80	70	60	50	40	30	20	10	0

## Sulfur

- Apply 20 - 40 lbs S/ac to ensure that adequate sulfur is available to meet crop needs.
- Broadcast S prior to seeding or use ammonium sulfate as an N source to supply needed S.
- Sulfate-S is available for crop uptake immediately after application. If a reduced form of S is applied (e.g., thiosulfate or elemental S), allow adequate time for oxidation of the applied S to the sulfate form to occur.

## Manganese

Manganese (Mn) needs are predicted by an Availability Index that includes M3 soil test Mn and soil pH. Interpretation is crop specific.

$$\text{MnAI} = 101.7 - (15.2 \times \text{soil pH}) + (2.11 \times \text{M3-Mn})$$

Where:

- MnAI = Mn availability index  
Soil pH = Soil pH measured in water (1:1 V:V)  
M3-Mn = Mehlich 3 soil test Mn in lbs/ac

**Table 5. Interpretation of Mn availability index.**

Mn Availability Index	Interpretation
Less than 12	Mn deficiency is possible. Monitor the crop for symptoms
12 or greater	Mn deficiency is unlikely.

1. If Mn deficiency is predicted or was observed in the previous growing season, broadcast 20-40 lbs actual Mn/ac.
2. Broadcast applications of acid forming fertilizers may correct Mn deficiency without the actual application of Mn in some cases, but may be less effective than applications of Mn. Long term application of acid forming fertilizers will require pH correction with lime.
3. If Mn deficiency symptoms appear during the growing season or after an application of lime, a foliar application of 0.5 to 2.0 lbs/ac actual Mn as Mn sulfate or chelated Mn can alleviate the symptoms and restore yield potential. **Apply only when adequate growth is present to aid absorption of foliar Mn.** Foliar application can be repeated if symptoms reappear.

## Zinc

Zinc (Zn) deficiency is predicted by an Availability Index that includes not only M3 soil test Zn, but also soil pH and M3 soil test P.

**Table 6. Interpretation of Zn availability index.**

Soil Test Criteria	Interpretation
M3-Zn is less than 1.9 lbs/ac	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac <b>AND</b> soil pH is 6.6 or higher <b>AND</b> M3-P is 100 FIVs or higher	Zn deficiency is predicted
M3-Zn is 3.2 lbs/ac or higher	Soil should be sufficient in Zn

If zinc deficiency is predicted by the availability index or was observed the previous year, one of the following treatments can be applied:

1. Broadcast 10-12 lbs/ac actual Zn as Zn sulfate or Zn oxide or 2-3 lbs/ac actual Zn as Zn chelate. Broadcast applications should correct Zn deficiency for several years.
2. Foliar application of 1 lb/ac actual Zn as Zn sulfate or Zn oxide or 0.5 lb/ac actual Zn as Zn chelate in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

## Boron

1. Apply 0.5 - 1.0 lbs B/ac each year.

2. Boron (B) can be applied in a blended, broadcast fertilizer, as a soil spray or applied in a foliar spray, generally in late May or June. ***Foliar applications should only be made when adequate growth is present to aid absorption of foliar B.***
3. **Caution:** Although B is required for maximum productivity of hay fields containing legumes, even slight over-application can be toxic to the crop. When applying B as a foliar spray, be certain to apply the correct rate.