

Alfalfa Pasture - Established Stand

Crop Highlights

- Best to use a grazing or rhizomatous alfalfa cultivar for grazing
- Always use freshly inoculated seed or apply fresh inoculum specific for alfalfa
- Rotational grazing works best with alfalfa

Yield Goal

A specific yield goal is not utilized for pastures. The goal of these recommendations is to ensure good pasture performance to meet the needs of livestock being grazed there.

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. 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.
2. If the available forage is less than 25% legumes, switch to a recommendation for grass/alfalfa mix.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate to promote adequate pasture performance and productivity.

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P ₂ O ₅ /ac	150	125	100	80	60	50	40	20	0	0	0

1. If soil test P is “Low” (e.g., 25 FIVs or less), satisfactory growth is unlikely. The grazing manager should evaluate the stand density to decide if replanting is appropriate since broadcasting and plowing down the recommended rate of P₂O₅ will produce higher yields sooner than will topdress applications.
2. If soil test P is “Medium” or “Optimum” (e.g., 26 to 100 FIVs), topdress phosphorus after the first grazing cycle.

- If soil test P is “Excessive” (e.g., P-FIV’s >100), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

Potassium

Table 3. Recommended potassium fertilizer rate to promote adequate pasture performance and productivity.

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

- Topdress potash after the first grazing cycle.
- Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate from mid-May to mid-June and the remainder in late August or September.

Magnesium

- Magnesium is recommended when Soil Test Magnesium is less than 38 FIVs
- 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

- Monitor forage for sulfur deficiency. If symptoms occur, contact your county agent for assistance with diagnosis and/or corrective recommendations.

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.
- 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 in adsorption of foliar Mn.**

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 AND soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac AND soil pH is 6.6 or higher AND 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. 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

- Apply 2.0 - 4.0 lbs B/ac each year.
- If the available forage in the pasture is less than 25% legumes, application of boron (B) is not required.
- Boron can be applied in a blended, broadcast fertilizer, as a soil spray or applied in a foliar spray, generally in late May or June.
- 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 Pasture - Established Stand

Crop Highlights
<ul style="list-style-type: none"> • Best to use a grazing, rhizomatous alfalfa cultivar for pasture • A Roundup Ready™ cultivar to establish a strong, weed-free alfalfa stand can help yield potential; no-till in a grass crop after alfalfa establishes • The combination of grass and broadleaf crop makes management difficult, especially weed control • In drought years, alfalfa will pull moisture from deep in soil restricting grass growth and possibly survival

Yield Goal

A specific yield goal is not utilized for pastures. The goal of these recommendations is to ensure good pasture performance to meet the needs of livestock being grazed there.

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. 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. If the forage mix is less than 25% legumes, follow the nitrogen recommendations below:
2. If forage growth is slow or inadequate for livestock needs, apply 40 - 60 lbs N/ac to encourage recovery and regrowth. Repeat application when needed. Do not apply more than 300 lbs N/ac per year.
3. Adjust the N application rate as productivity changes from one grazing cycle to the next, with expected weather conditions and as forage composition changes.
4. To promote deeper rooting of grasses, enhance winter survival and enhance spring recovery, apply 40-50 lbs N/ac between mid-October and mid-November.
5. If N **is applied** in mid-fall, a greenup N application should not be necessary. If growth is slow in the spring, a late April / early May application of 40-50 lbs N/ac will help push pasture growth.
6. If N **is not applied** in mid-fall, 40-60 lbs N/ac will be needed at the initiation of greenup to push early pasture growth.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate to promote adequate pasture performance and productivity.

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P ₂ O ₅ /ac	120	100	90	70	60	50	40	20	0	0	0

1. If soil test P is “Low” (e.g., 25 FIVs or less), satisfactory growth is unlikely. The grazing manager should evaluate the stand density to decide if replanting is appropriate since broadcasting and plowing down the recommended rate of P₂O₅ will produce higher yields sooner than will topdress applications.
2. If soil test P is “Medium” or “Optimum” (e.g., 26 to 100 FIVs), topdress phosphorus after the first grazing cycle.
3. If soil test P is “Excessive” (e.g., P-FIV’s >100), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

Potassium

Table 3. Recommended potassium fertilizer rate to promote adequate pasture performance and productivity.

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

1. Topdress potash after the first grazing cycle.
2. Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate from mid-May to mid-June and the remainder in late August or September.

Magnesium

1. Magnesium is recommended when Soil Test Magnesium is less than 38 FIVs
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. Monitor forage for sulfur (S) deficiency or use ammonium sulfate as an N source to supply needed S. Long-term applications of ammonium sulfate or other acid-forming fertilizers may lower pH of the soil surface and require correction with lime. Monitor surface pH with a 0-2 inch soil sample.
2. If deficiency symptoms occur, contact your county agent for assistance with diagnosis and/or corrective recommendations.

- Sulfate-S is available immediately 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.
- 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 in adsorption of foliar Mn.**

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 AND soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac AND soil pH is 6.6 or higher AND 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. 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. Apply 1.0 - 2.0 lbs B/ac each year.
2. If the available forage in the pasture is less than 25% legumes, application of boron (B) is not required.
3. Boron can be applied in a blended, broadcast fertilizer, as a soil spray or applied in a foliar spray, generally in late May or June.
4. **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.

Grass/Brassica Mixed Pasture - Established Stand

Crop Highlights

- Pearl millet and brassicas make excellent summer forage
- High protein content is associated with brassicas so be sure to include a grass for its fiber content
- Can be grazed in as little as 35 to 40 days after planting
- Brassicas are high in moisture so dung is often very loose

Yield Goal

A specific yield goal is not utilized for pastures. The goal of these recommendations is to ensure good pasture performance to meet the needs of livestock being grazed there.

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. If forage growth is slow or inadequate for livestock needs, apply 40 - 60 lbs N/ac to encourage recovery and regrowth. Repeat application when needed. Do not apply more than 300 lbs N/ac per year.
2. Adjust the N application rate as productivity changes from one grazing cycle to the next and with expected weather conditions.
3. To promote deeper rooting, enhance winter survival and enhance spring recovery, apply 40-50 lbs N/ac between mid-October and mid-November.
4. If N **is applied** in mid-fall, a greenup N application should not be necessary. If growth is slow in the spring, a late April / early May application of 40-50 lbs N/ac will help push pasture growth.
5. If N **is not applied** in mid-fall, 40-60 lbs N/ac will be needed at the initiation of greenup to push early pasture growth.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate to promote adequate pasture performance and productivity.

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P ₂ O ₅ /ac	120	100	90	70	60	50	40	20	0	0	0

1. If soil test P is “Low” (e.g., 25 FIVs or less), satisfactory growth is unlikely. The grazing manager should evaluate the stand density to decide if replanting is appropriate since broadcasting and plowing down the recommended rate of P₂O₅ will produce higher yields sooner than will topdress applications.
2. If soil test P is “Medium” or “Optimum” (e.g., 26 to 100 FIVs), topdress phosphorus after the first grazing cycle.
3. If soil test P is “Excessive” (e.g., P-FIV’s >100), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

Potassium

Table 3. Recommended potassium fertilizer rate to promote adequate pasture performance and productivity.

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

1. Topdress potash after the first grazing cycle.
2. Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate from mid-May to mid-June and the remainder in late August or September.

Magnesium

1. Magnesium is recommended when Soil Test Magnesium is less than 38 FIVs
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. Monitor forage for sulfur deficiency or use ammonium sulfate as an N source to supply needed S. Long-term applications of ammonium sulfate or other acid-forming fertilizers may lower pH of the soil surface and require correction with lime. Monitor surface pH with a 0-2 inch soil sample.
2. If deficiency symptoms occur, contact your county agent for assistance with diagnosis and/or corrective recommendations.

- Sulfate-S is available immediately 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.
- 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 in adsorption of foliar Mn.**

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 AND soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac AND soil pH is 6.6 or higher AND 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. 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/Chicory Mixed Pasture - Established Stand

Crop Highlights
<ul style="list-style-type: none"> • If not seeded together, chicory can be planted via no-till into grass stands if grazed heavily to lower competitiveness • Spring and summer forage production from chicory: Penn State reports 50 to 70 lbs/acre/day production from April through Oct. • Production is optimized under rotational grazing • Stand life can be 5 to 7 years with rotational grazing • Keep chicory from bolting in spring by grazing to a 1.5 inch stubble height and with rest periods of about 25 days

Yield Goal

A specific yield goal is not utilized for pastures. The goal of these recommendations is to ensure good pasture performance to meet the needs of livestock being grazed there.

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. If forage growth is slow or inadequate for livestock needs, apply 40 - 60 lbs N/ac to encourage recovery and regrowth. Repeat application when needed. Do not apply more than 300 lbs N/ac per year.
2. Adjust the N application rate as productivity changes from one grazing cycle to the next and with expected weather conditions.
3. To promote deeper rooting, enhance winter survival and enhance spring recovery, apply 40-50 lbs N/ac between mid-October and mid-November.
4. If N **is applied** in mid-fall, a greenup N application should not be necessary. If growth is slow in the spring, a late April / early May application of 40-50 lbs N/ac will help push pasture growth.
5. If N **is not applied** in mid-fall, 40-60 lbs N/ac will be needed at the initiation of greenup to push early pasture growth.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate to promote adequate pasture performance and productivity.

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P ₂ O ₅ /ac	120	100	90	70	60	50	40	20	0	0	0

1. If soil test P is “Low” (e.g., 25 FIVs or less), satisfactory growth is unlikely. The grazing manager should evaluate the stand density to decide if replanting is appropriate since broadcasting and plowing down the recommended rate of P₂O₅ will produce higher yields sooner than will topdress applications.
2. If soil test P is “Medium” or “Optimum” (e.g., 26 to 100 FIVs), topdress phosphorus after the first grazing cycle.
3. If soil test P is “Excessive” (e.g., P-FIV’s >100), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

Potassium

Table 3. Recommended potassium fertilizer rate to promote adequate pasture performance and productivity.

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

1. Topdress potash after the first grazing cycle.
2. Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate from mid-May to mid-June and the remainder in late August or September.

Magnesium

1. Magnesium is recommended when Soil Test Magnesium is less than 38 FIVs
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. Monitor forage for sulfur deficiency or use ammonium sulfate as an N source to supply needed S.
2. If deficiency symptoms occur, contact your county agent for assistance with diagnosis and/or corrective recommendations.
3. Sulfate-S is available immediately 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.
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 in adsorption of foliar Mn.**

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 AND soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac AND soil pH is 6.6 or higher AND 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. 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.

Kentucky Bluegrass Pasture - Established Stand

Crop Highlights

- Large majority of forage is produced in early spring with another small peak in the fall
- Can be grazed relatively closely due to extensive rhizome (underground stem) system
- If overgrazed, white clover often invades open areas

Yield Goal

A specific yield goal is not utilized for pastures. The goal of these recommendations is to ensure good pasture performance to meet the needs of livestock being grazed there.

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. If forage growth is slow or inadequate for livestock needs, apply 40 - 60 lbs N/ac to encourage recovery and regrowth. Repeat application when needed. Do not apply more than 300 lbs N/ac per year.
2. Adjust the N application rate as productivity changes from one grazing cycle to the next and with expected weather conditions.
3. To promote deeper rooting, enhance winter survival and enhance spring recovery, apply 40-50 lbs N/ac between mid-October and mid-November.
4. If N **is applied** in mid-fall, a greenup N application should not be necessary. If growth is slow in the spring, a late April / early May application of 40-50 lbs N/ac will help push pasture growth.
5. If N **is not applied** in mid-fall, 40-60 lbs N/ac will be needed at the initiation of greenup to push early pasture growth.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate to promote adequate pasture performance and productivity.

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P ₂ O ₅ /ac	120	100	90	70	60	50	40	20	0	0	0

1. If soil test P is “Low” (e.g., 25 FIVs or less), satisfactory growth is unlikely. The grazing manager should evaluate the stand density to decide if replanting is appropriate since broadcasting and plowing down the recommended rate of P₂O₅ will produce higher yields sooner than will topdress applications.
2. If soil test P is “Medium” or “Optimum” (e.g., 26 to 100 FIVs), topdress phosphorus after the first grazing cycle.
3. If soil test P is “Excessive” (e.g., P-FIV’s >100), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

Potassium

Table 3. Recommended potassium fertilizer rate to promote adequate pasture performance and productivity.

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

1. Topdress potash after the first grazing cycle.
2. Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate from mid-May to mid-June and the remainder in late August or September.

Magnesium

1. Magnesium is recommended when Soil Test Magnesium is less than 38 FIVs
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. Monitor forage for sulfur deficiency or use ammonium sulfate as an N source to supply needed S.
2. If deficiency symptoms occur, contact your county agent for assistance with diagnosis and/or corrective recommendations.
3. Sulfate-S is available immediately 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.
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 in adsorption of foliar Mn.**

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 AND soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac AND soil pH is 6.6 or higher AND 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. 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 Pasture - Established Stand

Crop Highlights

- More tolerant of acid soils than clover as well as of infertile droughty soils
- Although a legume, little N is shared between this crop and companion grasses
- Moderate levels of condensed tannins can reduce parasite loads in small ruminants
- Produces seeds in late summer/early fall if not overgrazed

Yield Goal

A specific yield goal is not utilized for pastures. The goal of these recommendations is to ensure good pasture performance to meet the needs of livestock being grazed there.

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. If forage growth is slow or inadequate for livestock needs, apply 40 - 60 lbs N/ac to encourage recovery and regrowth. Repeat application when needed. Do not apply more than 300 lbs N/ac per year.
2. Adjust the N application rate as productivity changes from one grazing cycle to the next and with expected weather conditions.
3. To promote deeper rooting, enhance winter survival and enhance spring recovery, apply 40-50 lbs N/ac between mid-October and mid-November.
4. If N **is applied** in mid-fall, a greenup N application should not be necessary. If growth is slow in the spring, a late April / early May application of 40-50 lbs N/ac will help push pasture growth.
5. If N **is not applied** in mid-fall, 40-60 lbs N/ac will be needed at the initiation of greenup to push early pasture growth.
6. 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.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate to promote adequate pasture performance and productivity.

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P ₂ O ₅ /ac	120	100	90	70	60	50	40	20	0	0	0

1. If soil test P is “Low” (e.g., 25 FIVs or less), satisfactory growth is unlikely. The grazing manager should evaluate the stand density to decide if replanting is appropriate since broadcasting and plowing down the recommended rate of P₂O₅ will produce higher yields sooner than will topdress applications.
2. If soil test P is “Medium” or “Optimum” (e.g., 26 to 100 FIVs), topdress phosphorus after the first grazing cycle.
3. If soil test P is “Excessive” (e.g., P-FIV’s >100), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

Potassium

Table 3. Recommended potassium fertilizer rate to promote adequate pasture performance and productivity.

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

1. Topdress potash after the first grazing cycle.
2. Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate from mid-May to mid-June and the remainder in late August or September.

Magnesium

1. Magnesium is recommended when Soil Test Magnesium is less than 38 FIVs
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. Monitor forage for sulfur deficiency or use ammonium sulfate as an N source to supply needed S.
2. If deficiency symptoms occur, contact your county agent for assistance with diagnosis and/or corrective recommendations.
3. Sulfate-S is available immediately 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.
- 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 in adsorption of foliar Mn.**

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 AND soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac AND soil pH is 6.6 or higher AND 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. 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 water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

Boron

- 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 Pasture - Established Stand

Crop Highlights

- Best use is as emergency forage as short-lived
- High productivity with adequate N and rainfall/irrigation
- Interval between one grazing cycle and next can be as short as 21 days

Yield Goal

A specific yield goal is not utilized for pastures. The goal of these recommendations is to ensure good pasture performance to meet the needs of livestock being grazed there.

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. If forage growth is slow or inadequate for livestock needs, apply 40 - 60 lbs N/ac to encourage recovery and regrowth. Repeat application when needed. Do not apply more than 300 lbs N/ac per year.
2. Adjust the N application rate as productivity changes from one grazing cycle to the next and with expected weather conditions.
3. To promote deeper rooting, enhance winter survival and enhance spring recovery, apply 40-50 lbs N/ac between mid-October and mid-November.
4. If N **is applied** in mid-fall, a greenup N application should not be necessary. If growth is slow in the spring, a late April / early May application of 40-50 lbs N/ac will help push pasture growth.
5. If N **is not applied** in mid-fall, 40-60 lbs N/ac will be needed at the initiation of greenup to push early pasture growth.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate to promote adequate pasture performance and productivity.

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P ₂ O ₅ /ac	120	100	90	70	60	50	40	20	0	0	0

1. If soil test P is “Low” (e.g., 25 FIVs or less), satisfactory growth is unlikely. The grazing manager should evaluate the stand density to decide if replanting is appropriate since broadcasting and plowing down the recommended rate of P₂O₅ will produce higher yields sooner than will topdress applications.
2. If soil test P is “Medium” or “Optimum” (e.g., 26 to 100 FIVs), topdress phosphorus after the first grazing cycle.
3. If soil test P is “Excessive” (e.g., P-FIV’s >100), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

Potassium

Table 3. Recommended potassium fertilizer rate to promote adequate pasture performance and productivity.

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

1. Topdress potash after the first grazing cycle.
2. Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate from mid-May to mid-June and the remainder in late August or September.

Magnesium

1. Magnesium is recommended when Soil Test Magnesium is less than 38 FIVs
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. Monitor forage for sulfur deficiency or use ammonium sulfate as an N source to supply needed S.
2. If deficiency symptoms occur, contact your county agent for assistance with diagnosis and/or corrective recommendations.
3. Sulfate-S is available immediately 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.
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 in adsorption of foliar Mn.**

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 AND soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac AND soil pH is 6.6 or higher AND 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. 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.

Mixed Grass / Legume Pasture - Established Stand

Crop Highlights

- The combination of grass and broadleaf crop makes management difficult, especially weed control
- In drought years, alfalfa will pull moisture from deep in soil restricting grass growth and possibly survival
- Manage mixture balance using rotational grazing, nitrogen fertilizer, grazing height, and grazing frequency

Yield Goal

A specific yield goal is not utilized for pastures. The goal of these recommendations is to ensure good pasture performance to meet the needs of livestock being grazed there.

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. If forage growth is slow or inadequate for livestock needs, apply 40 - 60 lbs N/ac to encourage recovery and regrowth. Repeat application when needed. Do not apply more than 300 lbs N/ac per year.
2. Adjust the N application rate as productivity changes from one grazing cycle to the next and with expected weather conditions.
3. To promote deeper rooting, enhance winter survival and enhance spring recovery, apply 40-50 lbs N/ac between mid-October and mid-November.
4. If N **is applied** in mid-fall, a greenup N application should not be necessary. If growth is slow in the spring, a late April / early May application of 40-50 lbs N/ac will help push pasture growth.
5. If N **is not applied** in mid-fall, 40-60 lbs N/ac will be needed at the initiation of greenup to push early pasture growth.
6. 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.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate to promote adequate pasture performance and productivity.

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P ₂ O ₅ /ac	120	100	90	70	60	50	40	20	0	0	0

1. If soil test P is “Low” (e.g., 25 FIVs or less), satisfactory growth is unlikely. The grazing manager should evaluate the stand density to decide if replanting is appropriate since broadcasting and plowing down the recommended rate of P₂O₅ will produce higher yields sooner than will topdress applications.
2. If soil test P is “Medium” or “Optimum” (e.g., 26 to 100 FIVs), topdress phosphorus after the first grazing cycle.
3. If soil test P is “Excessive” (e.g., P-FIV’s >100), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

Potassium

Table 3. Recommended potassium fertilizer rate to promote adequate pasture performance and productivity.

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

1. Topdress potash after the first grazing cycle.
2. Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate from mid-May to mid-June and the remainder in late August or September.

Magnesium

1. Magnesium is recommended when Soil Test Magnesium is less than 38 FIVs
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. Monitor forage for sulfur deficiency or use ammonium sulfate as an N source to supply needed S.
2. If deficiency symptoms occur, contact your county agent for assistance with diagnosis and/or corrective recommendations.
3. Sulfate-S is available immediately 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.
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 in adsorption of foliar Mn.**

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 AND soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac AND soil pH is 6.6 or higher AND 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. 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. If the available forage in the pasture is less than 25% legumes, application of boron (B) is not required.
3. Boron can be applied in a blended, broadcast fertilizer, as a soil spray or applied in a foliar spray, generally in late May or June.
4. **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 Pasture - Established Stand

Crop Highlights
<ul style="list-style-type: none"> • Orchardgrass decline syndrome is present in this region and shortens stand life • Keeping N and K fertilization matched is essential • Avoid grazing orchardgrass below four inches • Susceptible to leaf spot diseases in hot humid weather • Best on well-drained, highly fertile soil with good organic matter content • Not useful as a fall-accumulated winter grazing crop as quality declines rapidly after frost

Yield Goal

A specific yield goal is not utilized for pastures. The goal of these recommendations is to ensure good pasture performance to meet the needs of livestock being grazed there.

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. If forage growth is slow or inadequate for livestock needs, apply 40 - 60 lbs N/ac to encourage recovery and regrowth. Repeat application when needed. Do not apply more than 300 lbs N/ac per year.
2. Adjust the N application rate as productivity changes from one grazing cycle to the next and with expected weather conditions.
3. To promote deeper rooting, enhance winter survival and enhance spring recovery, apply 40-50 lbs N/ac between mid-October and mid-November.
4. If N **is applied** in mid-fall, a greenup N application should not be necessary. If growth is slow in the spring, a late April / early May application of 40-50 lbs N/ac will help push pasture growth.
5. If N **is not applied** in mid-fall, 40-60 lbs N/ac will be needed at the initiation of greenup to push early pasture growth.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate to promote adequate pasture performance and productivity.

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P ₂ O ₅ /ac	120	100	90	70	60	50	40	20	0	0	0

1. If soil test P is “Low” (e.g., 25 FIVs or less), satisfactory growth is unlikely. The grazing manager should evaluate the stand density to decide if replanting is appropriate since broadcasting and plowing down the recommended rate of P₂O₅ will produce higher yields sooner than will topdress applications.
2. If soil test P is “Medium” or “Optimum” (e.g., 26 to 100 FIVs), topdress phosphorus after the first grazing cycle.
3. If soil test P is “Excessive” (e.g., P-FIV’s >100), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

Potassium

Table 3. Recommended potassium fertilizer rate to promote adequate pasture performance and productivity.

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

1. Topdress potash after the first grazing cycle.
2. Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate from mid-May to mid-June and the remainder in late August or September.

Magnesium

1. Magnesium is recommended when Soil Test Magnesium is less than 38 FIVs
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. Monitor forage for sulfur deficiency or use ammonium sulfate as an N source to supply needed S.
2. If deficiency symptoms occur, contact your county agent for assistance with diagnosis and/or corrective recommendations.
3. Sulfate-S is available immediately 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.
- 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 in adsorption of foliar Mn.**

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 AND soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac AND soil pH is 6.6 or higher AND 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. 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

- 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 Pasture - Established Stand

Crop Highlights
<ul style="list-style-type: none"> • In Delaware, perennial ryegrass does best in the northern areas with adequate moisture • Tetraploid cultivars will yield more and stands last longer • Excellent for interseeding into declining alfalfa stands • Works best when a legume is included • Not useful as a fall-accumulated winter grazing crop as quality declines rapidly after frost

Yield Goal

A specific yield goal is not utilized for pastures. The goal of these recommendations is to ensure good pasture performance to meet the needs of livestock being grazed there.

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. If forage growth is slow or inadequate for livestock needs, apply 40 - 60 lbs N/ac to encourage recovery and regrowth. Repeat application when needed. Do not apply more than 300 lbs N/ac per year.
2. Adjust the N application rate as productivity changes from one grazing cycle to the next and with expected weather conditions.
3. To promote deeper rooting, enhance winter survival and enhance spring recovery, apply 40-50 lbs N/ac between mid-October and mid-November.
4. If N **is applied** in mid-fall, a greenup N application should not be necessary. If growth is slow in the spring, a late April / early May application of 40-50 lbs N/ac will help push pasture growth.
5. If N **is not applied** in mid-fall, 40-60 lbs N/ac will be needed at the initiation of greenup to push early pasture growth.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate to promote adequate pasture performance and productivity.

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P ₂ O ₅ /ac	120	100	90	70	60	50	40	20	0	0	0

1. If soil test P is “Low” (e.g., 25 FIVs or less), satisfactory growth is unlikely. The grazing manager should evaluate the stand density to decide if replanting is appropriate since broadcasting and plowing down the recommended rate of P₂O₅ will produce higher yields sooner than will topdress applications.
2. If soil test P is “Medium” or “Optimum” (e.g., 26 to 100 FIVs), topdress phosphorus after the first grazing cycle.
3. If soil test P is “Excessive” (e.g., P-FIV’s >100), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

Potassium

Table 3. Recommended potassium fertilizer rate to promote adequate pasture performance and productivity.

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

1. Topdress potash after the first grazing cycle.
2. Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate from mid-May to mid-June and the remainder in late August or September.

Magnesium

1. Magnesium is recommended when Soil Test Magnesium is less than 38 FIVs
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. Monitor forage for sulfur deficiency or use ammonium sulfate as an N source to supply needed S.
2. If deficiency symptoms occur, contact your county agent for assistance with diagnosis and/or corrective recommendations.
3. Sulfate-S is available immediately 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.
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 in adsorption of foliar Mn.**

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 AND soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac AND soil pH is 6.6 or higher AND 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. 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 Pasture - Established Stand

Crop Highlights

- Can be frost-crack seeded at the end of winter but stand density is often variable
- Best for cattle and sheep, not horses due to slobbers
- Best used with a companion forage grass
- Inoculum is often not needed due to how widespread clover use has been but won't hurt

Yield Goal

A specific yield goal is not utilized for pastures. The goal of these recommendations is to ensure good pasture performance to meet the needs of livestock being grazed there.

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. If forage growth is slow or inadequate for livestock needs, apply 40 - 60 lbs N/ac to encourage recovery and regrowth. Repeat application when needed. Do not apply more than 300 lbs N/ac per year.
2. Adjust the N application rate as productivity changes from one grazing cycle to the next and with expected weather conditions.
3. To promote deeper rooting, enhance winter survival and enhance spring recovery, apply 40-50 lbs N/ac between mid-October and mid-November.
4. If N **is applied** in mid-fall, a greenup N application should not be necessary. If growth is slow in the spring, a late April / early May application of 40-50 lbs N/ac will help push pasture growth.
5. If N **is not applied** in mid-fall, 40-60 lbs N/ac will be needed at the initiation of greenup to push early pasture growth.
6. 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.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate to promote adequate pasture performance and productivity.

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P ₂ O ₅ /ac	120	100	90	70	60	50	40	20	0	0	0

1. If soil test P is “Low” (e.g., 25 FIVs or less), satisfactory growth is unlikely. The grazing manager should evaluate the stand density to decide if replanting is appropriate since broadcasting and plowing down the recommended rate of P₂O₅ will produce higher yields sooner than will topdress applications.
2. If soil test P is “Medium” or “Optimum” (e.g., 26 to 100 FIVs), topdress phosphorus after the first grazing cycle.
3. If soil test P is “Excessive” (e.g., P-FIV’s >100), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

Potassium

Table 3. Recommended potassium fertilizer rate to promote adequate pasture performance and productivity.

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

1. Topdress potash after the first grazing cycle.
2. Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate from mid-May to mid-June and the remainder in late August or September.

Magnesium

1. Magnesium is recommended when Soil Test Magnesium is less than 38 FIVs
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. Monitor forage for sulfur deficiency or use ammonium sulfate as an N source to supply needed S.
2. If deficiency symptoms occur, contact your county agent for assistance with diagnosis and/or corrective recommendations.
3. Sulfate-S is available immediately 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.
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 in adsorption of foliar Mn.**

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 AND soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac AND soil pH is 6.6 or higher AND 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. 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. If the available forage in the pasture is less than 25% legumes, application of boron (B) is not required.
3. Boron can be applied in a blended, broadcast fertilizer, as a soil spray or applied in a foliar spray, generally in late May or June.
4. **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 Pasture - Established Stand

Crop Highlights
<ul style="list-style-type: none"> • Low alkaloid cultivars do best for cattle and sheep but goats have done well with common (high alkaloid) reed canarygrass • Requires careful management and longer recovery period between grazings • Only appropriate when rotational grazing is practiced • Grows well with Ladino-type white clover

Yield Goal

A specific yield goal is not utilized for pastures. The goal of these recommendations is to ensure good pasture performance to meet the needs of livestock being grazed there.

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. If forage growth is slow or inadequate for livestock needs, apply 40 - 60 lbs N/ac to encourage recovery and regrowth. Repeat application when needed. Do not apply more than 300 lbs N/ac per year.
2. Adjust the N application rate as productivity changes from one grazing cycle to the next and with expected weather conditions.
3. To promote deeper rooting, enhance winter survival and enhance spring recovery, apply 40-50 lbs N/ac between mid-October and mid-November.
4. If N **is applied** in mid-fall, a greenup N application should not be necessary. If growth is slow in the spring, a late April / early May application of 40-50 lbs N/ac will help push pasture growth.
5. If N **is not applied** in mid-fall, 40-60 lbs N/ac will be needed at the initiation of greenup to push early pasture growth.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate to promote adequate pasture performance and productivity.

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P ₂ O ₅ /ac	120	100	90	70	60	50	40	20	0	0	0

1. If soil test P is “Low” (e.g., 25 FIVs or less), satisfactory growth is unlikely. The grazing manager should evaluate the stand density to decide if replanting is appropriate since broadcasting and plowing down the recommended rate of P₂O₅ will produce higher yields sooner than will topdress applications.
2. If soil test P is “Medium” or “Optimum” (e.g., 26 to 100 FIVs), topdress phosphorus after the first grazing cycle.
3. If soil test P is “Excessive” (e.g., P-FIV’s >100), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

Potassium

Table 3. Recommended potassium fertilizer rate to promote adequate pasture performance and productivity.

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

1. Topdress potash after the first grazing cycle.
2. Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate from mid-May to mid-June and the remainder in late August or September.

Magnesium

1. Magnesium is recommended when Soil Test Magnesium is less than 38 FIVs
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. Monitor forage for sulfur deficiency or use ammonium sulfate as an N source to supply needed S.
2. If deficiency symptoms occur, contact your county agent for assistance with diagnosis and/or corrective recommendations.

- Sulfate-S is available immediately 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.
- 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 in adsorption of foliar Mn.**

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 AND soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac AND soil pH is 6.6 or higher AND 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. 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.

Smooth Bromegrass Pasture - Established Stand

Crop Highlights

- Very light fluffy (chaffy) seed.
- At best, suited only for very northern Delaware locations
- Can become sod bound without adequate N fertilization

Yield Goal

A specific yield goal is not utilized for pastures. The goal of these recommendations is to ensure good pasture performance to meet the needs of livestock being grazed there.

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. If forage growth is slow or inadequate for livestock needs, apply 40 - 60 lbs N/ac to encourage recovery and regrowth. Repeat application when needed. Do not apply more than 300 lbs N/ac per year.
2. Adjust the N application rate as productivity changes from one grazing cycle to the next and with expected weather conditions.
3. To promote deeper rooting, enhance winter survival and enhance spring recovery, apply 40-50 lbs N/ac between mid-October and mid-November.
4. If N **is applied** in mid-fall, a greenup N application should not be necessary. If growth is slow in the spring, a late April / early May application of 40-50 lbs N/ac will help push pasture growth.
5. If N **is not applied** in mid-fall, 40-60 lbs N/ac will be needed at the initiation of greenup to push early pasture growth.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate to promote adequate pasture performance and productivity.

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P ₂ O ₅ /ac	120	100	90	70	60	50	40	20	0	0	0

1. If soil test P is “Low” (e.g., 25 FIVs or less), satisfactory growth is unlikely. The grazing manager should evaluate the stand density to decide if replanting is appropriate since broadcasting and plowing down the recommended rate of P₂O₅ will produce higher yields sooner than will topdress applications.
2. If soil test P is “Medium” or “Optimum” (e.g., 26 to 100 FIVs), topdress phosphorus after the first grazing cycle.
3. If soil test P is “Excessive” (e.g., P-FIV’s >100), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

Potassium

Table 3. Recommended potassium fertilizer rate to promote adequate pasture performance and productivity.

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

1. Topdress potash after the first grazing cycle.
2. Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate from mid-May to mid-June and the remainder in late August or September.

Magnesium

1. Magnesium is recommended when Soil Test Magnesium is less than 38 FIVs
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. Monitor forage for sulfur deficiency or use ammonium sulfate as an N source to supply needed S.
2. If deficiency symptoms occur, contact your county agent for assistance with diagnosis and/or corrective recommendations.
3. Sulfate-S is available immediately 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.
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 in adsorption of foliar Mn.**

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 AND soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac AND soil pH is 6.6 or higher AND 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. 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.

Tall Fescue Pasture - Established Stand

Crop Highlights
<ul style="list-style-type: none"> • Old endophyte infected tall fescue cultivars can cause low weight gains, fescue foot, and other animal problems • Ideal for fall-accumulated forage for winter grazing • Novel or friendly-endophyte cultivars are preferred • N rates above 50 lb N/expected ton of yield under drought conditions can have high nitrate levels so test forage before grazing

Yield Goal

A specific yield goal is not utilized for pastures. The goal of these recommendations is to ensure good pasture performance to meet the needs of livestock being grazed there.

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. If forage growth is slow or inadequate for livestock needs, apply 40 - 60 lbs N/ac to encourage recovery and regrowth. Repeat application when needed. Do not apply more than 300 lbs N/ac per year.
2. Adjust the N application rate as productivity changes from one grazing cycle to the next and with expected weather conditions.
3. To promote deeper rooting, enhance winter survival and enhance spring recovery, apply 40-50 lbs N/ac between mid-October and mid-November.
4. If N **is applied** in mid-fall, a greenup N application should not be necessary. If growth is slow in the spring, a late April / early May application of 40-50 lbs N/ac will help push pasture growth.
5. If N **is not applied** in mid-fall, 40-60 lbs N/ac will be needed at the initiation of greenup to push early pasture growth.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate to promote adequate pasture performance and productivity.

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P ₂ O ₅ /ac	120	100	90	70	60	50	40	20	0	0	0

1. If soil test P is “Low” (e.g., 25 FIVs or less), satisfactory growth is unlikely. The grazing manager should evaluate the stand density to decide if replanting is appropriate since broadcasting and plowing down the recommended rate of P₂O₅ will produce higher yields sooner than will topdress applications.
2. If soil test P is “Medium” or “Optimum” (e.g., 26 to 100 FIVs), topdress phosphorus after the first grazing cycle.
3. If soil test P is “Excessive” (e.g., P-FIV’s >100), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

Potassium

Table 3. Recommended potassium fertilizer rate to promote adequate pasture performance and productivity.

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

1. Topdress potash after the first grazing cycle.
2. Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate from mid-May to mid-June and the remainder in late August or September.

Magnesium

1. Magnesium is recommended when Soil Test Magnesium is less than 38 FIVs
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. Monitor forage for sulfur deficiency or use ammonium sulfate as an N source to supply needed S.
2. If deficiency symptoms occur, contact your county agent for assistance with diagnosis and/or corrective recommendations.
3. Sulfate-S is available immediately 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.
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 in adsorption of foliar Mn.**

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 AND soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac AND soil pH is 6.6 or higher AND 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. 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 Pasture - Established Stand

Crop Highlights

- Timothy has haplocorms at the base of the plant that form in the fall and can be damaged by grazing animals
- Often, very site specific with respect to performance
- Cereal rust mite damage can appear as drought or severe N deficiency early in the spring

Yield Goal

A specific yield goal is not utilized for pastures. The goal of these recommendations is to ensure good pasture performance to meet the needs of livestock being grazed there.

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. If forage growth is slow or inadequate for livestock needs, apply 40 - 60 lbs N/ac to encourage recovery and regrowth. Repeat application when needed. Do not apply more than 300 lbs N/ac per year.
2. Adjust the N application rate as productivity changes from one grazing cycle to the next and with expected weather conditions.
3. To promote deeper rooting, enhance winter survival and enhance spring recovery, apply 40-50 lbs N/ac between mid-October and mid-November.
4. If N **is applied** in mid-fall, a greenup N application should not be necessary. If growth is slow in the spring, a late April / early May application of 40-50 lbs N/ac will help push pasture growth.
5. If N **is not applied** in mid-fall, 40-60 lbs N/ac will be needed at the initiation of greenup to push early pasture growth.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate to promote adequate pasture performance and productivity.

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P ₂ O ₅ /ac	120	100	90	70	60	50	40	20	0	0	0

1. If soil test P is “Low” (e.g., 25 FIVs or less), satisfactory growth is unlikely. The grazing manager should evaluate the stand density to decide if replanting is appropriate since broadcasting and plowing down the recommended rate of P₂O₅ will produce higher yields sooner than will topdress applications.
2. If soil test P is “Medium” or “Optimum” (e.g., 26 to 100 FIVs), topdress phosphorus after the first grazing cycle.
3. If soil test P is “Excessive” (e.g., P-FIV’s >100), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

Potassium

Table 3. Recommended potassium fertilizer rate to promote adequate pasture performance and productivity.

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

1. Topdress potash after the first grazing cycle.
2. Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate from mid-May to mid-June and the remainder in late August or September.

Magnesium

1. Magnesium is recommended when Soil Test Magnesium is less than 38 FIVs
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. Monitor forage for sulfur deficiency or use ammonium sulfate as an N source to supply needed S.
2. If deficiency symptoms occur, contact your county agent for assistance with diagnosis and/or corrective recommendations.
3. Sulfate-S is available immediately 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.
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 in adsorption of foliar Mn.**

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 AND soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lbs/ac AND soil pH is 6.6 or higher AND 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. 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.

White Clover Pasture - Established Stand

Crop Highlights
<ul style="list-style-type: none"> • Use in conjunction with a forage grass such as Kentucky bluegrass • Ladino-type cultivars are the only useful white clovers for hay • Unless planted with a companion crop, yield will be low consisting of leaves and flowers • Inoculum is often not needed due to how widespread clover use has been but won't hurt • White clover stands will share N with companion grasses

Yield Goal

A specific yield goal is not utilized for pastures. The goal of these recommendations is to ensure good pasture performance to meet the needs of livestock being grazed there.

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. If forage growth is slow or inadequate for livestock needs, apply 40 - 60 lbs N/ac to encourage recovery and regrowth. Repeat application when needed. Do not apply more than 300 lbs N/ac per year.
2. If the available forage is less than 25% legumes, switch to a recommendation for grass / legume mix.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate to promote adequate pasture performance and productivity.

Fertilizer	UD FIVs										
	0	10	20	30	40	50	60	70	80	90	100
lbs P ₂ O ₅ /ac	120	100	90	70	60	50	40	20	0	0	0

1. If soil test P is "Low" (e.g., 25 FIVs or less), satisfactory growth is unlikely. The grazing manager should evaluate the stand density to decide if replanting is appropriate since broadcasting and plowing down the recommended rate of P₂O₅ will produce higher yields sooner than will topdress applications.

- If soil test P is “Medium” or “Optimum” (e.g., 26 to 100 FIVs), topdress phosphorus after the first grazing cycle.
- If soil test P is “Excessive” (e.g., P-FIV’s >100), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.

Potassium

Table 3. Recommended potassium fertilizer rate to promote adequate pasture performance and productivity.

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

- Topdress potash after the first grazing cycle.
- Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate from mid-May to mid-June and the remainder in late August or September.

Magnesium

- Magnesium is recommended when Soil Test Magnesium is less than 38 FIVs
- 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

- Monitor forage for sulfur deficiency or use ammonium sulfate as an N source to supply needed S.
- If deficiency symptoms occur, contact your county agent for assistance with diagnosis and/or corrective recommendations.
- Sulfate-S is available immediately 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.

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

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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.
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 in adsorption of foliar Mn.**

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.

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Soil Test Criteria	Interpretation
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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. 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. If the available forage in the pasture is less than 25% legumes, application of boron (B) is not required.
3. Boron can be applied in a blended, broadcast fertilizer, as a soil spray or applied in a foliar spray, generally in late May or June.
4. **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.