

Bermudagrass Hay - Established Stand

Crop Highlights
<ul style="list-style-type: none"> • High tonnage is possible as well as high protein levels • Growers may need to tightly pack bales to prevent excessive field losses • Responds well to N fertilizer • Starts growth late in the spring but grows well during the heat of summer • Growth slows in Sept/Oct. and as night temperatures decline • Can be cut very frequently

Yield Goal

The target yield goal for this crop is 5 tons per acre per year.

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. An initial application of 40 - 60 lbs N/ac should be applied when growth begins in mid- to late spring.
2. Additional applicationS of N may be needed in summer to promote maximum production.
3. After each cut, apply 40 – 60 lbs N/ac per ton of expected per acre yield for the next cut (e.g., if the expected yield of the next cut is 2 tons/ac, apply 80 - 120 lbs N/ac).
4. Adjust the N application rate as expected yield changes from cut to cut and with expected weather conditions.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate at 5 ton/ac yield goal. See adjustments below for higher yield goals.

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. 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
4. Increase recommended P rate by 20 lbs P₂O₅/ac/ton for each additional ton of expected yield

Potassium

Table 3. Recommended potassium fertilizer rate at 5 ton/ac yield goal. See adjustments below for higher yield goals.

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 cutting.
2. Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate after the first cutting and the remainder in August or early September.
3. Increase recommended K rate by 75 lbs K₂O /ac/ton for each additional ton of expected yield.

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. Apply 20 - 40 lbs S/ac to ensure that adequate sulfur is available to meet crop needs.
2. Topdress S annually or use ammonium sulfate as an N source to supply needed S.
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 absorption 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 or 2-3 lbs/ac actual Zn as Zn chelate. Broadcast applications should correct Zn deficiency for several years.
2. Foliar application of 1 lb/ac actual Zn as Zn sulfate or Zn oxide or 0.5 lb/ac actual Zn as Zn chelate in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

Boron

1. Boron (B) deficiency is not common in warm season grass hay crops. If symptoms are observed in the field, contact your county agent for assistance with diagnosis and corrective treatments.

Big Bluestem Hay - Established Stand

Crop Highlights
<ul style="list-style-type: none"> • Harvest for quality at early- to mid-heading or full head for heavier yield • Leave a 6 to 8 inch stubble when cutting • If cut again after seed head emergence, allow adequate time for regrowth before frost • Stems are thick and will require conditioning by crimping • Quality can be very good for a warm-season grass

Yield Goal

The target yield goal for this crop is 3 tons per acre per year.

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. An initial application of 40 - 60 lbs N/ac should be applied when growth begins in mid- to late spring.
2. After each cut, apply 20 - 40 lbs N/ac per ton of expected per acre yield for the next cut (e.g., if the expected yield of the next cut is 2 tons/ac, apply 40 - 80 lbs N/ac).
3. Adjust the N application rate as expected yield changes from cut to cut and with expected weather conditions.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate at 3 ton/ac yield goal. See adjustments below for higher yield goals.

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. 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
- Increase recommended P rate by 0 lbs P₂O₅/ac/ton for each additional ton of expected yield

Potassium

Table 3. Recommended potassium fertilizer rate at 3 ton/ac yield goal. See adjustments below for higher yield goals.

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 cutting.
- Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate after the first cutting 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.

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

Boron

1. Boron (B) deficiency is not common in warm season grass hay crops. If symptoms are observed in the field, contact your county agent for assistance with diagnosis and corrective treatments.

Eastern Gamagrass Hay - Established Stand

Crop Highlights
<ul style="list-style-type: none"> • Take initial harvest at mid- to late-heading • Can be harvested 3 to 4 times a year if leave a 6 to 8 inch stubble to assist recovery • Has performed well when round baled • Earliest warm-season grass to head out • Excellent palatability

Yield Goal

The target yield goal for this crop is 4 tons per acre per year.

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. An initial application of 40 - 60 lbs N/ac should be applied when growth begins in early spring, followed by additional N in early June as needed.
2. Additional applications of N may be needed in summer to promote maximum production.
3. After each cut, apply 40 - 60 lbs N/ac per ton of expected per acre yield for the next cut (e.g., if the expected yield of the next cut is 2 tons/ac, apply 80 - 120 lbs N/ac).
4. Adjust the N application rate as expected yield changes from cut to cut and with expected weather conditions.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate at 4 ton/ac yield goal. See adjustments below for higher yield goals.

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. 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
4. Increase recommended P rate by 20 lbs P₂O₅/ac/ton for each additional ton of expected yield

Potassium

Table 3. Recommended potassium fertilizer rate at 4 ton/ac yield goal. See adjustments below for higher yield goals.

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 cutting.
2. Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate after the first cutting and the remainder in late August or September.
3. Increase recommended K rate by 50 lbs K₂O /ac/ton for each additional ton of expected yield.

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. Apply 20 - 40 lbs S/ac to ensure that adequate sulfur is available to meet crop needs.
2. Topdress S annually or use ammonium sulfate as an N source to supply needed S.
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 absorption 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 or 2-3 lbs/ac actual Zn as Zn chelate. Broadcast applications should correct Zn deficiency for several years.
2. Foliar application of 1 lb/ac actual Zn as Zn sulfate or Zn oxide or 0.5 lb/ac actual Zn as Zn chelate in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid absorption of foliar Zn.** Application should be repeated if symptoms re-appear.

Boron

1. Boron (B) deficiency is not common in warm season grass hay crops. If symptoms are observed in the field, contact your county agent for assistance with diagnosis and corrective treatments.

Indiangrass Hay - Established Stand

Crop Highlights
<ul style="list-style-type: none"> • New stands may take two years to establish sufficiently before they can be cut for hay • Limit number of harvest to maintain stand • Requires high stubble (at least minimum 6 to 8 inches) • Indiangrass, a native warm-season grass, heads late in the summer

Yield Goal

The target yield goal for this crop is 3 tons per acre per year.

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. An initial application of 40 - 60 lbs N/ac should be applied when growth begins in mid- to late spring, followed by additional N in early June as needed.
2. After each cut, apply 20 - 40 lbs N/ac per ton of expected per acre yield for the next cut (e.g., if the expected yield of the next cut is 2 tons/ac, apply 40 - 80 lbs N/ac).
3. Adjust the N application rate as expected yield changes from cut to cut and with expected weather conditions.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate at 3 ton/ac yield goal. See adjustments below for higher yield goals.

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. 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 at 3 ton/ac yield goal. See adjustments below for higher yield goals.

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 cutting.
- Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate after the first cutting and the remainder in August or early 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.

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

Boron

1. Boron (B) deficiency is not common in warm season grass hay crops. If symptoms are observed in the field, contact your county agent for assistance with diagnosis and corrective treatments.

Little Bluestem Hay - Established Stand

Crop Highlights
<ul style="list-style-type: none"> • Rotational grazing is mandatory to maintain stand life • Much shorter stature than other warm-season grasses and lower yielding • New stands may take two years to establish sufficiently before they can be cut for hay

Yield Goal

The target yield goal for this crop is 1.5 tons per acre per year.

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. An initial application of 40 - 60 lbs N/ac should be applied when growth begins in mid- to late spring, followed by additional N in early June as needed.
2. After each cut, apply 20 - 40 lbs N/ac per ton of expected per acre yield for the next cut (e.g., if the expected yield of the next cut is 2 tons/ac, apply 40 - 80 lbs N/ac).
3. Adjust the N application rate as expected yield changes from cut to cut and with expected weather conditions.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate at 1.5 ton/ac yield goal. See adjustments below for higher yield goals.

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. 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 at 1.5 ton/ac yield goal. See adjustments below for higher yield goals.

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 cutting.
- Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate after the first cutting and the remainder in August or early 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.

Manganese

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

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

Where:

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

Table 5. Interpretation of Mn availability index.

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

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

Boron

1. Boron (B) deficiency is not common in warm season grass hay crops. If symptoms are observed in the field, contact your county agent for assistance with diagnosis and corrective treatments.

Switchgrass Hay - Established Stand

Crop Highlights
<ul style="list-style-type: none"> • Switchgrass, a native warm-season grass, heads earlier than bluestem or Indiangrass • If the sole feed source for ruminants, switchgrass, a Panicum species, can cause liver lesions in ruminant species

Yield Goal

The target yield goal for this crop is 3 tons per acre per year.

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. An initial application of 40 - 60 lbs N/ac should be applied when growth begins in mid- to late spring, followed by additional N in early June as needed.
2. After each cut, apply 20 - 40 lbs N/ac per ton of expected per acre yield for the next cut (e.g., if the expected yield of the next cut is 2 tons/ac, apply 40 - 80 lbs N/ac).
3. Adjust the N application rate as expected yield changes from cut to cut and with expected weather conditions.

Phosphorus

Table 2. Recommended phosphorus fertilizer rate at 3 ton/ac yield goal. See adjustments below for higher yield goals.

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. 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 at 3 ton/ac yield goal. See adjustments below for higher yield goals.

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 cutting.
- Application rates of 120 lbs K₂O /ac or higher should be split into two treatments. Apply ½ of the recommended rate after the first cutting and the remainder in August or early 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.

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

Boron

1. Boron (B) deficiency is not common in warm season grass hay crops. If symptoms are observed in the field, contact your county agent for assistance with diagnosis and corrective treatments.