

# Soil Test Interpretations and Fertilizer Recommendations in Kansas



**K-STATE**  
Research and Extension

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

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**The following abbreviations are used in this publication.**

B = Boron

Fe = Iron

Bu = Bushel

K = Potassium

Cl = Chlorine

Mn = Manganese

CSTV = Critical Soil Test Value

Mo = Molybdenum

Cu = Copper

N = Nitrogen

DTPA = Diethylene-triaminepentaacetic acid

P = Phosphorus

ppm = Parts per million

ECC = Effective Calcium Carbonate

S = Sulfur

Zn = Zinc

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# General Guide

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Development of sound nutrient management programs involves understanding a wide range of information. Soil test records are an important piece of that information, but other factors, such as soil moisture conditions, land ownership/tenure, crop and cropping sequence, pest management, cultural practices, environmental issues, and other management items are vital for developing sound nutrient management programs. It is beyond the scope of this publication to detail the ramifications of all these factors, but they should not be overlooked when finalizing nutrient application programs.

The following tables, equations, and accompanying information are the most recent soil test interpretations for major crops for the most commonly deficient plant nutrients in Kansas. These interpretations are valid for interpreting soil test values from the KSU Soil Testing Laboratory and other laboratories using the same soil testing procedures.

## Expected Yield

Suggested recommended application rates are tied to expected yields for several nutrients. Yield records should be used to set an individual and realistic, but progressive, expected yield for each field. An appropriate expected yield for a specific field should be high enough to take advantage of high production years when they occur, but not so high as to jeopardize environmental stewardship and/or profitability when environmental conditions are not favorable. Appropriate expected yield should be about 105% of the average yield obtained in a field over the past three to five years.

## Soil Sampling Depth

Interpretations for the nitrate-N, sulfate-S and chloride-Cl soil tests are based on a 0- to 24-inch soil profile sampling depth. All other nutrient interpretations are based on surface soil samples collected to a depth of 0 to 6 inches. Collect a sample from the 0- to 24-inch depth for nitrogen (N), sulfur (S) and chlorine (Cl) recommendations and a separate 0- to 6-inch sample for pH, phosphorus (P), potassium (K), zinc (Zn), iron (Fe), and boron (B) soil test determinations.

For lime, the recommended lime rate should be adjusted to reflect the depth of lime incorporation,

while no-till and perennial crops should assume a depth of 2 inches.

## Appropriate Soil Test Procedures

These soil test interpretations are based on the following soil test procedures: All tests referred to in this publication are among the tests recommended for the North Central Region by the NCERA-13 Regional Committee on Soil Testing and Plant Analysis. These are described in the North Central Regional Publication 221 (Revised 2012) *Recommended Chemical Soil Test Procedures for the North Central Region*.

**Soil pH:** 1:1 Water pH

**Buffer pH:** Sikora Buffer (determines lime requirement)

**Nitrogen:** Available Nitrate-N

**Phosphorus:**

- Mehlich 3 Extractable P (Colorimetric)
- Bray P1 Extractable P
- Olsen P – multiply by 1.6 and interpret similarly to Mehlich 3 Colorimetric

**Potassium:** Mehlich 3 Extractable or Ammonium Acetate Extractable

**Zinc, Iron and Boron:** DTPA Extractable

**Sulfur:** Calcium Phosphate Extractable Sulfate

**Chloride:** Mercury (II) Thiocyanate Extractable (Colorimetric)

## Soil pH and Liming Interpretations

The Sikora buffer pH is determined and used for lime rate calculations in acidic soils. Options are provided for liming to various target pHs and information is provided for various areas of the state to aid in selection of an appropriate target pH, based on subsoil acidity and crops to be grown.

## Phosphorus and Potassium Interpretations

Kansas State University phosphorus and potassium recommendations provide two main options for producers, depending on circumstances for specific producers, fields and situations.

‘Sufficiency’ fertility programs are intended to estimate the long-term fertilizer phosphorus or potassium required to provide optimum economic return in the year of nutrient application while achieving about 90 to 95% of maximum yield. In some years, greater amounts of nutrient are required for optimum yield and economic return, while in other years less than recommended amounts of nutrient would suffice. There is little consideration of future soil test values, and soil test values will likely stabilize in the ‘low’ (i.e., deficient) sufficiency range.

“Build-maintenance” recommendations are intended to apply enough phosphorus or potassium to build soil test range to a target soil test value over a planned time frame (typically four to eight years) and then maintain soil test values in a target range in future years. If the soil test is within the target range, then recommended nutrient application rates are equal to crop removal. If soil test values exceed the target range, no phosphorus or potassium is recommended with the exception of low starter applied rates, if desired. Build-maintenance fertility programs are not intended to provide optimum economic returns in a given year, but rather attempt to minimize the probability of phosphorus or potassium limiting crop yields while providing for near maximum yield potential. The nutrient concentrations per unit of yield for various agronomic crops are presented in Table 1, which can be used in conjunction with yield data to calculate the total crop removal over a period of time.

**Table 1. Phosphorus and Potassium Crop Removal Values**

| Crop             | Unit of yield | Moisture for yield basis | Nutrient                      |                  |
|------------------|---------------|--------------------------|-------------------------------|------------------|
|                  |               |                          | P <sub>2</sub> O <sub>5</sub> | K <sub>2</sub> O |
| Alfalfa & Clover | Ton           | 15%                      | 12                            | 60               |
| Bermudagrass     | Ton           | 15%                      | 12                            | 40               |
| Bromegrass       | Ton           | 15%                      | 12                            | 40               |
| Fescue, tall     | Ton           | 15%                      | 12                            | 40               |
| Corn             | Bushel        | 15.5%                    | 0.33                          | 0.26             |
| Corn silage      | Ton           | 65%                      | 3.20                          | 8.70             |
| Grain sorghum    | Bushel        | 15.5%                    | 0.40                          | 0.26             |
| Sorghum silage   | Ton           | 65%                      | 3.20                          | 8.70             |
| Wheat            | Bushel        | 13.5%                    | 0.50                          | 0.30             |
| Sunflowers       | Pound         | 10%                      | 0.015                         | 0.006            |
| Oats             | Bushel        | 14%                      | 0.25                          | 0.20             |
| Soybeans         | Bushel        | 13%                      | 0.80                          | 1.40             |
| Native grass     | Ton           | 15%                      | 5.40                          | 30               |

## Secondary/Micronutrient Interpretations

The KSU Soil Testing Lab offers soil tests and interpretations for sulfur, zinc, chloride, iron, and boron. Detailed information is provided for interpreting soil test values for these nutrients and for recommending rates of application if they are deficient. To date in Kansas, we have not documented deficiencies of manganese (Mn), copper (Cu), or molybdenum (Mo) and do not offer interpretations for these micronutrients.

## Nitrogen Recommendations

The nitrogen requirement for a specific crop and expected yield is adjusted by considering many field specific factors. The K-State nitrogen recommendation guidelines for all crops are directly adjusted for soil organic matter content. Twenty pounds of available nitrogen per acre is expected to be mineralized during the crop year for each 1.0% soil organic matter in the surface 6 inches for warm season crops (e.g., corn, grain sorghum), while 10 pounds nitrogen per acre is expected to be mineralized for each 1.0% soil organic matter for cool season crops (e.g., wheat). In addition, the previous crop, residual profile nitrogen, manure applications, irrigation water nitrogen content, grazing nitrogen removal and the tillage system used are additional factors used to refine suggested nitrogen application rates for specific crop situations. Detailed information for major crops is provided. Since nitrate (NO<sub>3</sub><sup>-</sup>-N) is mobile, we encourage use of a 0- to 24-inch soil sample to assess the profile nitrogen content (also for sulfate and chloride as they are mobile in soils as well).

How and when nitrogen is applied can have a dramatic effect on how efficiently it will be used by the crop. For example, using delayed or split nitrogen applications on irrigated fields, particularly on sandy soils, often improves nitrogen use efficiency by reducing the potential for loss. Also, for high residue systems such as no-till, placing fertilizer nitrogen below the residue or dribbling nitrogen solution in concentrated bands on the soil surface offers the potential for improved nitrogen use efficiency for summer crops. Many factors other than application rate influence nitrogen use efficiency and should be considered when developing the overall nutrient management plan. The Kansas State University nitrogen recommendation guidelines offer efficiency factor adjustments based on crop and fertilizer management.

# Nitrogen Rate Recommendation Adjustments

## Cool Season Crops

### Soil Organic Matter (SOM) Adjustment

$\text{lb N/a Adjustment} = \% \text{ SOM} \times 10$

### Manure N

|             |      |                            |
|-------------|------|----------------------------|
| Inorganic N | 100% | of Manure Worksheet value* |
| Organic N   | 50%  | of Manure Worksheet value* |

### Profile N Test (2 foot sampling depth, if possible)

|         |    |  |
|---------|----|--|
| Default | 30 | lb N/a if Profile N Sample Not Collected |
|---------|----|--|

$\text{lb N/a} = 0.3 \times \text{Sampling Depth (inches)} \times \text{ppm Profile Nitrate-N}$

### Tillage Adjustment

|                      |      |        |
|----------------------|------|--------|
| Conventional Tillage | 0    | lb N/a |
| No-Tillage           | + 20 | lb N/a |

### Grazing Adjustment

40 lb N per 100 lb beef weight gain per acre

### Previous Crop Adjustment

|                        |      |        |
|------------------------|------|--------|
| Corn, Wheat            | 0    | lb N/a |
| Sorghum, Sunflowers    | + 30 | lb N/a |
| Soybeans               | 0    | lb N/a |
| Fallow                 |      |        |
| Without Profile N Test | - 20 | lb N/a |
| With Profile N Test    | 0    | lb N/a |

### With Stand Destruction Tillage, for no-till production reduce N credit adjustment by 50%

#### Alfalfa

|   |      |        |
|---|------|--------|
| Excellent Stand (> 5 plants/ft <sup>2</sup> ) | - 60 | lb N/a |
| Good Stand (2 – 5 plants/ft <sup>2</sup> )    | - 40 | lb N/a |
| Fair Stand (1 – 2 plants/ft <sup>2</sup> )    | - 20 | lb N/a |
| Poor Stand (< 1 plant/ft <sup>2</sup> )       | 0    | lb N/a |

#### Red Clover

|                 |      |        |
|-----------------|------|--------|
| Excellent Stand | - 40 | lb N/a |
| Good Stand      | - 20 | lb N/a |
| Poor Stand      | 0    | lb N/a |

#### Sweet Clover

|                 |      |        |
|-----------------|------|--------|
| Excellent Stand | - 55 | lb N/a |
| Good Stand      | - 30 | lb N/a |
| Poor Stand      | 0    | lb N/a |

\*Estimating Manure Nutrient Availability, MF2562

# Nitrogen Rate Recommendation Adjustments

## Warm Season Crops

### Soil Organic Matter (SOM) Adjustment

$\text{lb N/a Adjustment} = \% \text{ SOM} \times 20$

### Manure N

Inorganic N 100% of Manure Worksheet value\*

Organic N 100% of Manure Worksheet value\*

### Profile N Test (2 foot sampling depth , if possible)

Default 30 lb N/a if Profile N Sample Not Collected

$\text{lb N/a} = 0.3 \times \text{Sampling Depth (inches)} \times \text{ppm Profile Nitrate-N}$

### Irrigation Water Nitrate N

$\text{lb N/a} = \text{ppm Nitrate-N in Water} \times 0.226 \times \text{Inches Irrigation Water Applied}$

### Previous Crop Adjustment

Corn, Wheat 0 lb N/a

Sorghum, Sunflowers 0 lb N/a

Soybeans - 40 lb N/a

#### Fallow

Without Profile N Test - 20 lb N/a

With Profile N Test 0 lb N/a

### With Stand Destruction Tillage, for no-till production reduce N credit adjustment by 50%

#### Alfalfa

Excellent Stand (> 5 plants/ft<sup>2</sup>) - 120 lb N/a

Good Stand (2 – 5 plants/ft<sup>2</sup>) - 80 lb N/a

Fair Stand (12 – 2 plants/ft<sup>2</sup>) - 40 lb N/a

Poor Stand (< 1 plant/ft<sup>2</sup>) 0 lb N/a

#### Red Clover

Excellent Stand - 80 lb N/a

Good Stand - 40 lb N/a

Poor Stand 0 lb N/a

#### Sweet Clover

Excellent Stand - 110 lb N/a

Good Stand - 60 lb N/a

Poor Stand 0 lb N/a

\*Estimating Manure Nutrient Availability, MF2562

# Nitrogen Recommendations

## Corn

$$N \text{ (lb/a)} = (ie/fe) EY - (se) \text{ Profile N} - (\% \text{ SOM} \times 20) - \text{Manure N} - \text{Other N Adjustments} + \text{Previous Crop Adjustments}$$

### ie (corn internal efficiency) lbs/bu

|               |      |
|---------------|------|
| Irrigated     | 0.84 |
| Non-Irrigated | 0.88 |

### fe (fertilizer recovery efficiency)

|                 |      |                                   |
|-----------------|------|-----------------------------------|
| High efficiency | 0.65 | Injected or split applied         |
| Default         | 0.55 | Broadcast, fall-applied pre-plant |

### se ("soil" NO<sub>3</sub> efficiency)

|                      |     |                              |
|----------------------|-----|------------------------------|
| Low risk for N loss  | 1.0 | Medium texture or western KS |
| High risk for N loss | 0.7 | Coarse texture or eastern KS |

### Efficiency factors:

*ie*: internal crop efficiency

*fe*: fertilizer efficiency

*se*: soil nitrate-N efficiency

EY: expected yield (bu/a)

Profile N: profile NO<sub>3</sub> (lb/a)

SOM: soil organic matter (×20 for summer crops) lb N/a

Previous crop adjustment: lb/a (see pages 3 and 4)

- Maximum fertilizer N recommendations are 230 lb N/a for dryland corn production and 300 lb N/a for irrigated corn production.
- A minimum fertilizer N application of 30 lb N/a is recommended for early crop growth and development.

## Grain Sorghum

$$N \text{ (lb/a)} = (ie/fe) EY - (se) \text{ Profile N} - (\% \text{ SOM} \times 20) - \text{Manure N} - \text{Other N Adjustments} + \text{Previous Crop Adjustments}$$

### ie (sorghum internal efficiency) lbs/bu: 1.2

### fe (fertilizer recovery efficiency)

|                 |      |                                   |
|-----------------|------|-----------------------------------|
| High efficiency | 0.65 | Injected or split applied         |
| Default         | 0.55 | Broadcast, fall-applied pre-plant |

### se ("soil" NO<sub>3</sub> efficiency)

|                      |     |                              |
|----------------------|-----|------------------------------|
| Low risk for N loss  | 1.0 | Medium texture or western KS |
| High risk for N loss | 0.7 | Coarse texture or eastern KS |

### Efficiency factors:

*ie*: internal crop efficiency

*fe*: fertilizer efficiency

*se*: soil nitrate-N efficiency

EY: expected yield (bu/a)

Profile N: profile NO<sub>3</sub> (lb/a)

SOM: soil organic matter (×20 for summer crops) lb N/a

Previous crop adjustment: lb/a see pages 3 and 4)

- A minimum fertilizer N application of 30 lb N/a is recommended for early crop growth and development.

# Nitrogen Recommendations

## Wheat

$$N \text{ (lb/a)} = (ie/fe) EY - (se) \text{ Profile N} - (\% \text{ SOM} \times 10) - \text{Manure N} - \text{Other N Adjustments} + \text{Previous Crop Adjustments}$$

**ie (wheat internal efficiency) lbs/bu: 1.45**

### fe (fertilizer recovery efficiency)

|                 |      |                                   |
|-----------------|------|-----------------------------------|
| High efficiency | 0.65 | Injected or split applied         |
| Default         | 0.55 | Broadcast, fall-applied pre-plant |

### se ("soil" NO<sub>3</sub> efficiency)

|                      |     |                              |
|----------------------|-----|------------------------------|
| Low risk for N loss  | 1.0 | Medium texture or western KS |
| High risk for N loss | 0.7 | Coarse texture or eastern KS |

### Efficiency factors:

*ie*: internal crop efficiency

*fe*: fertilizer efficiency

*se*: soil nitrate-N efficiency

EY: expected yield (bu/a)

Profile N: profile NO<sub>3</sub> (lb/a)

SOM: soil organic matter (×10 for winter crops) lb N/a

Previous crop adjustment: lb/a (see pages 3 and 4)

- A minimum fertilizer N application of 30 lb N/a is recommended for early crop growth and development.

## Sunflower

$$N \text{ Rec} = (EY \times 0.075) - (\% \text{ SOM} \times 20) - \text{Profile N} - \text{Manure N} - \text{Other N Adjustments} + \text{Previous Crop Adjustments}$$

- A minimum fertilizer N application of 30 lb N/a may be appropriate for early crop growth and development.

## Oats

$$N \text{ Rec} = (EY \times 1.3) - (\% \text{ SOM} \times 10) - \text{Profile N} - \text{Other N Adjustments} + \text{Previous Crop Adjustments} + \text{Tillage Adjustments}$$

- A minimum fertilizer N application of 30 lb N/a may be appropriate for early crop growth and development.

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# Nitrogen Recommendations

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## Corn/Sorghum Silage

$$\text{N Rec} = (\text{EY} \times 10.67) - (\% \text{ SOM} \times 20) - \text{Profile N} - \text{Manure N} - \text{Other N Adjustments} + \text{Previous Crop Adjustments}$$

- Maximum fertilizer N recommendations are 230 lb N/a for dryland corn production and 300 lb N/a for irrigated corn production. A minimum fertilizer N application of 30 lb N/a may be appropriate for early crop growth and development. Expected yield (ton/a) is expressed at 65% moisture.

## Brome, Fescue and Bermudagrass

Nitrogen required at various expected yields. The total N requirements presented only include expected yield adjustments, and the total N requirements should be modified for other appropriate adjustments.

| Expected Yield<br>(ton/a) | Production<br>(lb N/a) | New Seeding<br>(lb N/a) |
|---------------------------|------------------------|-------------------------|
| 2                         | 80                     | 20                      |
| 4                         | 160                    | 20                      |
| 6                         | 240                    | 20                      |
| 8                         | 320                    | 20                      |
| 10                        | 400                    | 20                      |

# Liming Recommendations

The appropriate target pH varies by region based on subsoil acidity; lime rates are based on 6-inch soil depth. Soil depth is the depth of lime incorporation through tillage. For no-till systems, alfalfa and grass – assume 2-inch depth of incorporation (about one third of the rate for 6-inch depth). When lime recommendation exceeds 10,000 lb ECC/a, we suggest applying one-half rate, incorporate, wait 12 to 18 months and then retest.

$$\text{Target pH of 6.8} = [28,300 - (7100 \times \text{Buffer pH}) + (\text{Buffer pH} \times \text{Buffer pH} \times 449)] \times \text{Depth (inches)}$$

- All crops in southeast Kansas – east of Flint Hills and south of Highway 56
- Alfalfa and clover in northeast Kansas
- Lime Rec if pH < 6.4

$$\text{Target pH of 6.0} = [14,100 - (3,540 \times \text{Buffer pH}) + (\text{Buffer pH} \times \text{Buffer pH} \times 224)] \times \text{Depth (inches)}$$

- All crops in northeast Kansas except alfalfa and clover
- All crops in central and western Kansas
- Lime Rec if pH < 5.8

$$\text{Target pH of 5.5} = [7,060 - (1770 \times \text{Buffer pH}) + (\text{Buffer pH} \times \text{Buffer pH} \times 112)] \times \text{Depth (inches)}$$

- Cash flow/lime availability problem areas in central and western Kansas
- Lime Rec if pH < 5.5

## Liming Recommendations in Pounds of Effective Calcium Carbonate (lb ECC/a)

| Sikora Buffer pH | Target pH = 6.8      | Target pH = 6.0 | Target pH = 5.5 |
|------------------|----------------------|-----------------|-----------------|
|                  | ----- lb ECC/a ----- |                 |                 |
| 7.1              | 3,100                | 1,500           | 800             |
| 7.0              | 3,600                | 1,800           | 900             |
| 6.9              | 4,100                | 2,000           | 1,100           |
| 6.8              | 4,700                | 2,300           | 1,200           |
| 6.7              | 5,300                | 2,600           | 1,400           |
| 6.6              | 6,000                | 3,000           | 1,500           |
| 6.5              | 6,700                | 3,300           | 1,700           |
| 6.4              | 7,500                | 3,700           | 1,900           |
| 6.3              | 8,300                | 4,100           | 2,100           |
| 6.2              | 9,200                | 4,600           | 2,300           |
| 6.1              | 10,200               | 5,000           | 2,600           |
| 6.0              | 11,200               | 5,500           | 2,800           |
| 5.9              | 12,200               | 6,100           | 3,100           |
| 5.8              | 13,300               | 6,600           | 3,400           |
| 5.7              | 14,500               | 7,200           | 3,700           |

# Phosphorus Recommendations

## Corn

$$\text{Corn Sufficiency P Rec} = [50 + (\text{Expected Yield} \times 0.2) + (\text{Mehlich-3 P} \times -2.5) + (\text{Expected Yield} \times \text{Mehlich-3 P} \times -0.01)]$$

Crop P recommendations are for the total amount of broadcast and banded nutrients to be applied. At a very low soil test level, applying at least 25 to 50% of total as a band is recommended.

If Mehlich-3 P is greater than 20 ppm, then only starter fertilizer is suggested, and defined as a maximum of 20 lb P<sub>2</sub>O<sub>5</sub>/a applied at planting. If Mehlich-3 P is less than 20 ppm, then the minimum P recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

Application of starter fertilizer containing NP, NPK or NPKS may be beneficial regardless of P soil test level, especially for cold/wet soil conditions and/or high surface crop residues. For in-furrow applica-

tions do not exceed N + K<sub>2</sub>O guidelines for fertilizer placed in direct seed contact.

### Phosphorus Sufficiency Recommendations

| Mehlich-3 P<br>Soil Test<br>(ppm) | Category  | Expected Yield (bu/a) |     |     |     |     |
|-----------------------------------|-----------|-----------------------|-----|-----|-----|-----|
|                                   |           | 80                    | 120 | 160 | 200 | 240 |
| 0 – 8                             | Very Low  | 55                    | 60  | 65  | 70  | 80  |
| 9 – 15                            | Low       | 25                    | 30  | 35  | 35  | 40  |
| 16 – 20                           | Medium    | 15                    | 15  | 15  | 15  | 15  |
| 21 – 30                           | High      | 0                     | 0   | 0   | 0   | 0   |
| 31+                               | Very High | 0                     | 0   | 0   | 0   | 0   |

$$\text{Phosphorus Build-Maintenance Rec} = \left\{ \frac{(20 - \text{Current P Soil Test}) \times 18}{\text{Years To Build}} \right\} + \text{P}_2\text{O}_5 \text{ Removal In Crop}$$

The goal of the initial phase is to build the soil test value to the critical soil test value (CSTV) of 20 ppm, and subsequently maintain it within the range of 20 to 30 ppm through crop removal replacement. The quantity of P<sub>2</sub>O<sub>5</sub> fertilizer required to elevate the soil test P value differs according to soil type, in addition to differences in P removal and cycling, therefore regular soil sampling is necessary to keep track of soil test levels.

Four-, six-, and eight-year time frames below are examples only. Build programs can be over longer time frames, however, build-maintenance recommendations should not be less than crop sufficiency-based fertility programs.

### Phosphorus Build-Maintenance Recommendations

| Mehlich-3 P<br>Soil Test<br>(ppm) | Category  | 4-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     | 6-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     | 8-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     |
|-----------------------------------|-----------|---|-----|-----|---|-----|-----|---|-----|-----|
|                                   |           | 80  | 160 | 240 | 80  | 160 | 240 | 80  | 160 | 240 |
| 0 – 8                             | Very Low  | 98  | 125 | 151 | 74  | 101 | 127 | 62  | 89  | 115 |
| 9 – 15                            | Low       | 62  | 89  | 115 | 50  | 77  | 103 | 44  | 71  | 97  |
| 16 – 20                           | Medium    | 35  | 62  | 88  | 32  | 59  | 85  | 31  | 57  | 84  |
| 21 – 30*                          | High      | 26  | 53  | 79  | 26  | 53  | 79  | 26  | 53  | 79  |
| 30+                               | Very High | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

\*Recommended amounts of P<sub>2</sub>O<sub>5</sub> are based on crop nutrient removal only.

# Phosphorus Recommendations

## Wheat

$$\text{Wheat Sufficiency P Rec} = [46 + (\text{Expected Yield} \times 0.42) + (\text{Mehlich-3 P} \times -2.3) + (\text{Expected Yield} \times \text{Mehlich-3 P} \times -0.021)]$$

Crop P recommendations are for the total amount of broadcast and banded nutrients to be applied. At a very low soil test level, applying at least 25 to 50% of total as a band is recommended. Wheat is generally considered more responsive to band-applied P fertilizer.

If Mehlich-3 P is greater than 20 ppm, then only starter fertilizer is suggested, and defined as a maximum of 20 lb P<sub>2</sub>O<sub>5</sub>/a applied at planting. If Mehlich-3 P is less than 20 ppm, then the minimum P recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

Application of NP, NPK or NPKS starter fertilizer may be beneficial regardless of P or K soil test level, especially for cold/wet soil conditions and/or high

surface crop residues. Do not exceed N + K<sub>2</sub>O guidelines for fertilizer placed in direct seed contact.

### Phosphorus Sufficiency Recommendations

| Mehlich-3 P<br>Soil Test<br>(ppm) | Category  | Expected Yield (bu/a) |    |    |    |    |
|-----------------------------------|-----------|-----------------------|----|----|----|----|
|                                   |           | 30                    | 40 | 50 | 60 | 70 |
| 0 – 8                             | Very Low  | 45                    | 50 | 55 | 55 | 60 |
| 9 – 15                            | Low       | 25                    | 25 | 25 | 30 | 30 |
| 16 – 20                           | Medium    | 15                    | 15 | 15 | 15 | 15 |
| 21 – 30                           | High      | 0                     | 0  | 0  | 0  | 0  |
| 31+                               | Very High | 0                     | 0  | 0  | 0  | 0  |

$$\text{Phosphorus Build-Maintenance Rec} = \left\{ \frac{(20 - \text{Current P Soil Test}) \times 18}{\text{Years To Build}} \right\} + \text{P}_2\text{O}_5 \text{ Removal In Crop}$$

The goal of the initial phase is to build the soil test value to the critical soil test value (CSTV) of 20 ppm, and subsequently maintain it within the range of 20 to 30 ppm through crop removal replacement. The quantity of P<sub>2</sub>O<sub>5</sub> fertilizer required to elevate the soil test P value differs according to soil type, in addition to differences in P removal and cycling, therefore regular soil sampling is necessary to keep track of soil test levels.

Four-, six-, and eight-year time frames below are examples only. Build programs can be over longer time frames, however, build-maintenance recommendations should not be less than crop sufficiency-based fertility programs.

### Phosphorus Build-Maintenance Recommendations

| Mehlich-3 P<br>Soil Test<br>(ppm) | Category  | 4-Year Build Time Frame,<br>Expected Yield (bu/a) |    |     | 6-Year Build Time Frame,<br>Expected Yield (bu/a) |    |    | 8-Year Build Time Frame,<br>Expected Yield (bu/a) |    |    |
|-----------------------------------|-----------|---|----|-----|---|----|----|---|----|----|
|                                   |           | 30  | 50 | 70  | 30  | 50 | 70 | 30  | 50 | 70 |
| 0 – 8                             | Very Low  | 87  | 97 | 107 | 63  | 73 | 83 | 51  | 61 | 71 |
| 9 – 15                            | Low       | 51  | 61 | 71  | 39  | 49 | 59 | 33  | 43 | 53 |
| 16 – 20                           | Medium    | 24  | 34 | 44  | 21  | 31 | 41 | 20  | 30 | 40 |
| 21 – 30*                          | High      | 15  | 25 | 35  | 15  | 25 | 35 | 15  | 25 | 35 |
| 30+                               | Very High | 0   | 0  | 0   | 0   | 0  | 0  | 0   | 0  | 0  |

\*Recommended amounts of P<sub>2</sub>O<sub>5</sub> are based on crop nutrient removal only.

# Phosphorus Recommendations

## Grain Sorghum

$$\text{Grain Sorghum Sufficiency P Rec} = [50 + (0.16 \times \text{Expected Yield}) + (\text{Mehlich-3 P} \times -2.5) + (\text{Expected Yield} \times \text{Mehlich-3 P} \times -0.008)]$$

Crop P recommendations are for the total amount of broadcast and banded nutrients to be applied. At a very low soil test level, applying at least 25 to 50% of total as a band is recommended.

If Mehlich-3 P is greater than 20 ppm, then only starter fertilizer is suggested, and defined as a maximum of 20 lb P<sub>2</sub>O<sub>5</sub>/a applied at planting. If Mehlich-3 P is less than 20 ppm, then the minimum P recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

Application of starter fertilizer containing NP, NPK or NPKS may be beneficial regardless of P soil test level, especially for cold/wet soil conditions and/or high surface crop residues. For in-furrow applica-

tions do not exceed N + K<sub>2</sub>O guidelines for fertilizer placed in direct seed contact.

### Phosphorus Sufficiency Recommendations

| Mehlich-3 P<br>Soil Test<br>(ppm) | Category  | Expected Yield (bu/a) |    |     |     |     |
|-----------------------------------|-----------|-----------------------|----|-----|-----|-----|
|                                   |           | 40                    | 80 | 120 | 160 | 200 |
| 0 – 8                             | Very Low  | 45                    | 50 | 55  | 60  | 65  |
| 9 – 15                            | Low       | 25                    | 25 | 30  | 30  | 35  |
| 16 – 20                           | Medium    | 15                    | 15 | 15  | 15  | 15  |
| 21 – 30                           | High      | 0                     | 0  | 0   | 0   | 0   |
| 31+                               | Very High | 0                     | 0  | 0   | 0   | 0   |

$$\text{Phosphorus Build-Maintenance Rec} = \left\{ \frac{(20 - \text{Current P Soil Test}) \times 18}{\text{Years To Build}} \right\} + \text{P}_2\text{O}_5 \text{ Removal In Crop}$$

The goal of the initial phase is to build the soil test value to the critical soil test value (CSTV) of 20 ppm, and subsequently maintain it within the range of 20 to 30 ppm through crop removal replacement. The quantity of P<sub>2</sub>O<sub>5</sub> fertilizer required to elevate the soil test P value differs according to soil type, in addition to differences in P removal and cycling, therefore regular soil sampling is necessary to keep track of soil test levels.

Four-, six-, and eight-year time frames below are examples only. Build programs can be over longer time frames, however, build-maintenance recommendations should not be less than crop sufficiency-based fertility programs.

### Phosphorus Build-Maintenance Recommendations

| Mehlich-3 P<br>Soil Test<br>(ppm) | Category  | 4-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     | 6-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     | 8-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     |
|-----------------------------------|-----------|---|-----|-----|---|-----|-----|---|-----|-----|
|                                   |           | 40  | 120 | 200 | 40  | 120 | 200 | 40  | 120 | 200 |
| 0 – 8                             | Very Low  | 88  | 120 | 152 | 64  | 96  | 128 | 52  | 84  | 116 |
| 9 – 15                            | Low       | 52  | 84  | 116 | 40  | 72  | 104 | 34  | 66  | 98  |
| 16 – 20                           | Medium    | 25  | 57  | 89  | 22  | 54  | 86  | 21  | 53  | 85  |
| 21 – 30*                          | High      | 16  | 48  | 80  | 16  | 48  | 80  | 16  | 48  | 80  |
| 30+                               | Very High | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

\*Recommended amounts of P<sub>2</sub>O<sub>5</sub> are based on crop nutrient removal only.

# Phosphorus Recommendations

## Soybean

$$\text{Soybeans Sufficiency P Rec} = [56 + (0.51 \times \text{Expected Yield}) + (\text{Mehlich-3 P} \times -2.8) + (\text{Expected Yield} \times \text{Mehlich-3 P} \times -0.0257)]$$

Crop P recommendations are for the total amount of broadcast and banded nutrients to be applied. At a very low soil test level, applying at least 25 to 50% of total as a band is recommended.

If Mehlich-3 P is greater than 20 ppm, then only starter fertilizer is suggested, and defined as a maximum of 20 lb P<sub>2</sub>O<sub>5</sub>/a applied at planting. If Mehlich-3 P is less than 20 ppm, then the minimum P recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

Application of starter fertilizer containing NP, NPK or NPKS may be beneficial regardless of P soil test level, especially for cold/wet soil conditions and/or high surface crop residues. Soybean seedlings are

particularly sensitive to fertilizer damage, and fertilizer placed in direct seed contact is not recommended.

### Phosphorus Sufficiency Recommendations

| Mehlich-3 P<br>Soil Test<br>(ppm) | Category  | Expected Yield (bu/a) |    |    |    |    |
|-----------------------------------|-----------|-----------------------|----|----|----|----|
|                                   |           | 40                    | 50 | 60 | 70 | 80 |
| 0 – 8                             | Very Low  | 60                    | 65 | 70 | 75 | 75 |
| 9 – 15                            | Low       | 30                    | 30 | 35 | 35 | 40 |
| 16 – 20                           | Medium    | 15                    | 15 | 15 | 15 | 15 |
| 21 – 30                           | High      | 0                     | 0  | 0  | 0  | 0  |
| 31+                               | Very High | 0                     | 0  | 0  | 0  | 0  |

$$\text{Phosphorus Build-Maintenance Rec} = \left\{ \frac{(20 - \text{Current P Soil Test}) \times 18}{\text{Years To Build}} \right\} + \text{P}_2\text{O}_5 \text{ Removal In Crop}$$

The goal of the initial phase is to build the soil test value to the critical soil test value (CSTV) of 20 ppm, and subsequently maintain it within the range of 20 to 30 ppm through crop removal replacement. The quantity of P<sub>2</sub>O<sub>5</sub> fertilizer required to elevate the soil test P value differs according to soil type, in addition to differences in P removal and cycling, therefore regular soil sampling is necessary to keep track of soil test levels.

Four-, six-, and eight-year time frames below are examples only. Build programs can be over longer time frames, however, build-maintenance recommendations should not be less than crop sufficiency-based fertility programs.

### Phosphorus Build-Maintenance Recommendations

| Mehlich-3 P<br>Soil Test<br>(ppm) | Category  | 4-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     | 6-Year Build Time Frame,<br>Expected Yield (bu/a) |    |     | 8-Year Build Time Frame,<br>Expected Yield (bu/a) |    |     |
|-----------------------------------|-----------|---|-----|-----|---|----|-----|---|----|-----|
|                                   |           | 40  | 60  | 80  | 40  | 60 | 80  | 40  | 60 | 80  |
| 0 – 8                             | Very Low  | 104   | 120 | 136 | 80  | 96 | 112 | 68  | 84 | 100 |
| 9 – 15                            | Low       | 68  | 84  | 100 | 56  | 72 | 88  | 50  | 66 | 82  |
| 16 – 20                           | Medium    | 41  | 57  | 73  | 38  | 54 | 70  | 37  | 53 | 69  |
| 21 – 30*                          | High      | 32  | 48  | 64  | 32  | 48 | 64  | 32  | 48 | 64  |
| 30+                               | Very High | 0   | 0   | 0   | 0   | 0  | 0   | 0   | 0  | 0   |

\*Recommended amounts of P<sub>2</sub>O<sub>5</sub> are based on crop nutrient removal only.

# Phosphorus Recommendations

## Sunflower

$$\text{Sunflower Sufficiency P Rec} = [42 + (\text{Expected Yield} \times 0.01) + (\text{Mehlich-3 P} \times -2.1) + (\text{Expected Yield} \times \text{Mehlich-3 P} \times -0.0005)]$$

Crop P recommendations are for the total amount of broadcast and banded nutrients to be applied. At a very low soil test level, applying at least 25 to 50% of total as a band is recommended.

If Mehlich-3 P is greater than 20 ppm, then only starter fertilizer is suggested, and defined as a maximum of 20 lb P<sub>2</sub>O<sub>5</sub>/a applied at planting. If Mehlich-3 P is less than 20 ppm, then the minimum P recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

Application of starter fertilizer containing NP, NPK or NPKS may be beneficial regardless of P soil test level, especially for cold/wet soil conditions and/or high surface crop residues. For in-furrow applica-

tions do not exceed N + K<sub>2</sub>O guidelines for fertilizer placed in direct seed contact.

### Phosphorus Sufficiency Recommendations

| Mehlich-3 P<br>Soil Test<br>(ppm) | Category  | Expected Yield (lb/a) |       |       |       |       |
|-----------------------------------|-----------|-----------------------|-------|-------|-------|-------|
|                                   |           | 1,000                 | 1,500 | 2,000 | 2,500 | 3,000 |
| 0 – 8                             | Very Low  | 40                    | 45    | 50    | 55    | 60    |
| 9 – 15                            | Low       | 20                    | 25    | 25    | 25    | 30    |
| 16 – 20                           | Medium    | 15                    | 15    | 15    | 15    | 15    |
| 21 – 30                           | High      | 0                     | 0     | 0     | 0     | 0     |
| 31+                               | Very High | 0                     | 0     | 0     | 0     | 0     |

$$\text{Phosphorus Build-Maintenance Rec} = \left\{ \frac{(20 - \text{Current P Soil Test}) \times 18}{\text{Years To Build}} \right\} + \text{P}_2\text{O}_5 \text{ Removal In Crop}$$

The goal of the initial phase is to build the soil test value to the critical soil test value (CSTV) of 20 ppm, and subsequently maintain it within the range of 20 to 30 ppm through crop removal replacement. The quantity of P<sub>2</sub>O<sub>5</sub> fertilizer required to elevate the soil test P value differs according to soil type, in addition to differences in P removal and cycling, therefore regular soil sampling is necessary to keep track of soil test levels.

Four-, six-, and eight-year time frames below are examples only. Build programs can be over longer time frames, however, build-maintenance recommendations should not be less than crop sufficiency-based fertility programs.

### Phosphorus Build-Maintenance Recommendations

| Mehlich-3 P<br>Soil Test<br>(ppm) | Category  | 4-Year Build Time Frame,<br>Expected Yield (lb/a) |       |       | 6-Year Build Time Frame,<br>Expected Yield (lb/a) |       |       | 8-Year Build Time Frame,<br>Expected Yield (lb/a) |       |       |
|-----------------------------------|-----------|---|-------|-------|---|-------|-------|---|-------|-------|
|                                   |           | 1,000   | 2,000 | 3,000 | 1,000   | 2,000 | 3,000 | 1,000   | 2,000 | 3,000 |
| 0 – 8                             | Very Low  | 87  | 102   | 117   | 63  | 78    | 93    | 51  | 66    | 81    |
| 9 – 15                            | Low       | 51  | 66    | 81    | 39  | 54    | 69    | 33  | 48    | 63    |
| 16 – 20                           | Medium    | 24  | 39    | 54    | 21  | 36    | 51    | 20  | 35    | 50    |
| 21 – 30*                          | High      | 15  | 30    | 45    | 15  | 30    | 45    | 15  | 30    | 45    |
| 30+                               | Very High | 0   | 0     | 0     | 0   | 0     | 0     | 0   | 0     | 0     |

\*Recommended amounts of P<sub>2</sub>O<sub>5</sub> are based on crop nutrient removal only.

# Phosphorus Recommendations

## Oats

$$\text{Oats Sufficiency P Rec} = [47 + (\text{Expected Yield} \times 0.25) + (\text{Mehlich-3 P} \times -2.3) + (\text{Expected Yield} \times \text{Mehlich-3 P} \times -0.013)]$$

Crop P recommendations are for the total amount of broadcast and banded nutrients to be applied. At a very low soil test level, applying at least 25 to 50% of total as a band is recommended. Oat is generally considered more responsive to band-applied P fertilizer.

If Mehlich-3 P is greater than 20 ppm, then only starter fertilizer is suggested, and defined as a maximum of 20 lb P<sub>2</sub>O<sub>5</sub>/a applied at planting. If Mehlich-3 P is less than 20 ppm, then the minimum P recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

Application of starter fertilizer containing NP, NPK or NPKS may be beneficial regardless of P soil test level, especially for cold/wet soil conditions and/

or high surface crop residues. For in-furrow applications do not exceed N + K<sub>2</sub>O guidelines for fertilizer placed in direct seed contact.

### Phosphorus Sufficiency Recommendations

| Mehlich-3 P<br>Soil Test<br>(ppm) | Category  | Expected Yield (bu/a) |    |     |     |     |
|-----------------------------------|-----------|-----------------------|----|-----|-----|-----|
|                                   |           | 60                    | 80 | 100 | 120 | 140 |
| 0 – 8                             | Very Low  | 50                    | 55 | 60  | 60  | 65  |
| 9 – 15                            | Low       | 25                    | 25 | 30  | 30  | 35  |
| 16 – 20                           | Medium    | 15                    | 15 | 15  | 15  | 15  |
| 21 – 30                           | High      | 0                     | 0  | 0   | 0   | 0   |
| 31+                               | Very High | 0                     | 0  | 0   | 0   | 0   |

$$\text{Phosphorus Build-Maintenance Rec} = \left\{ \frac{(20 - \text{Current P Soil Test}) \times 18}{\text{Years To Build}} \right\} + \text{P}_2\text{O}_5 \text{ Removal In Crop}$$

The goal of the initial phase is to build the soil test value to the critical soil test value (CSTV) of 20 ppm, and subsequently maintain it within the range of 20 to 30 ppm through crop removal replacement. The quantity of P<sub>2</sub>O<sub>5</sub> fertilizer required to elevate the soil test P value differs according to soil type, in addition to differences in P removal and cycling, therefore regular soil sampling is necessary to keep track of soil test levels.

Four-, six-, and eight-year time frames below are examples only. Build programs can be over longer time frames, however, build-maintenance recommendations should not be less than crop sufficiency-based fertility programs.

### Phosphorus Build-Maintenance Recommendations

| Mehlich-3 P<br>Soil Test<br>(ppm) | Category  | 4-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     | 6-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     | 8-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     |
|-----------------------------------|-----------|---|-----|-----|---|-----|-----|---|-----|-----|
|                                   |           | 60  | 100 | 140 | 60  | 100 | 140 | 60  | 100 | 140 |
| 0 – 8                             | Very Low  | 87  | 97  | 107 | 63  | 73  | 83  | 51  | 61  | 71  |
| 9 – 15                            | Low       | 51  | 61  | 71  | 39  | 49  | 59  | 33  | 43  | 53  |
| 16 – 20                           | Medium    | 24  | 34  | 44  | 21  | 31  | 41  | 20  | 30  | 40  |
| 21 – 30*                          | High      | 15  | 25  | 35  | 15  | 25  | 35  | 15  | 25  | 35  |
| 30+                               | Very High | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

\*Recommended amounts of P<sub>2</sub>O<sub>5</sub> are based on crop nutrient removal only.

# Phosphorus Recommendations

## Corn Silage

$$\text{Corn Silage Sufficiency P Rec} = [56 + (\text{Expected Yield} \times 1.12) + (\text{Mehlich-3 P} \times -2.8) + (\text{Expected Yield} \times \text{Mehlich-3 P} \times -0.056)]$$

Crop P recommendations are for the total amount of broadcast and banded nutrients to be applied. At a very low soil test level, applying at least 25 to 50% of total as a band is recommended.

If Mehlich-3 P is greater than 20 ppm, then only starter fertilizer is suggested, and defined as a maximum of 20 lb P<sub>2</sub>O<sub>5</sub>/a applied at planting. If Mehlich-3 P is less than 20 ppm, then the minimum P recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

Application of starter fertilizer containing NP, NPK or NPKS may be beneficial regardless of P soil test level, especially for cold/wet soil conditions and/or high surface crop residues. For in-furrow applica-

tions do not exceed N + K<sub>2</sub>O guidelines for fertilizer placed in direct seed contact.

### Phosphorus Sufficiency Recommendations

| Mehlich-3 P<br>Soil Test<br>(ppm) | Category  | Expected Yield (ton/a) |    |    |    |    |
|-----------------------------------|-----------|------------------------|----|----|----|----|
|                                   |           | 10                     | 15 | 20 | 25 | 30 |
| 0 – 8                             | Very Low  | 55                     | 60 | 65 | 65 | 70 |
| 9 – 15                            | Low       | 25                     | 30 | 30 | 35 | 35 |
| 16 – 20                           | Medium    | 15                     | 15 | 15 | 15 | 15 |
| 21 – 30                           | High      | 0                      | 0  | 0  | 0  | 0  |
| 31+                               | Very High | 0                      | 0  | 0  | 0  | 0  |

$$\text{Phosphorus Build-Maintenance Rec} = \left\{ \frac{(\text{20} - \text{Current P Soil Test}) \times 18}{\text{Years To Build}} \right\} + \text{P}_2\text{O}_5 \text{ Removal In Crop}$$

The goal of the initial phase is to build the soil test value to the critical soil test value (CSTV) of 20 ppm, and subsequently maintain it within the range of 20 to 30 ppm through crop removal replacement. The quantity of P<sub>2</sub>O<sub>5</sub> fertilizer required to elevate the soil test P value differs according to soil type, in addition to differences in P removal and cycling, therefore regular soil sampling is necessary to keep track of soil test levels.

Four-, six-, and eight-year time frames below are examples only. Build programs can be over longer time frames, however, build-maintenance recommendations should not be less than crop sufficiency-based fertility programs.

### Phosphorus Build-Maintenance Recommendations

| Mehlich-3 P<br>Soil Test<br>(ppm) | Category  | 4-Year Build Time Frame,<br>Expected Yield (ton/a) |     |     | 6-Year Build Time Frame,<br>Expected Yield (ton/a) |     |     | 8-Year Build Time Frame,<br>Expected Yield (ton/a) |     |     |
|-----------------------------------|-----------|--|-----|-----|--|-----|-----|--|-----|-----|
|                                   |           | 10   | 20  | 30  | 10   | 20  | 30  | 10   | 20  | 30  |
| 0 – 8                             | Very Low  | 104  | 136 | 168 | 80   | 112 | 144 | 68   | 100 | 132 |
| 9 – 15                            | Low       | 68   | 100 | 132 | 56   | 88  | 120 | 50   | 82  | 114 |
| 16 – 20                           | Medium    | 41   | 73  | 105 | 38   | 70  | 102 | 37   | 69  | 101 |
| 21 – 30*                          | High      | 32   | 64  | 96  | 32   | 64  | 96  | 32   | 64  | 96  |
| 31+                               | Very High | 0  | 0   | 0   | 0  | 0   | 0   | 0  | 0   | 0   |

\*Recommended amounts of P<sub>2</sub>O<sub>5</sub> are based on crop nutrient removal only.

# Phosphorus Recommendations

## Sorghum Silage

$$\text{Sorghum Silage Sufficiency P Rec} = [48 + (1.19 \times \text{Expected Yield}) + (\text{Mehlich-3 P} \times -2.38) + (\text{Expected Yield} \times \text{Mehlich-3 P} \times -0.0594)]$$

Crop P recommendations are for the total amount of broadcast and banded nutrients to be applied. At a very low soil test level, applying at least 25 to 50% of total as a band is recommended.

If Mehlich-3 P is greater than 20 ppm, then only starter fertilizer is suggested, and defined as a maximum of 20 lb P<sub>2</sub>O<sub>5</sub>/a applied at planting. If Mehlich-3 P is less than 20 ppm, then the minimum P recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

Application of starter fertilizer containing NP, NPK or NPKS may be beneficial regardless of P soil test level, especially for cold/wet soil conditions and/or high surface crop residues. For in-furrow applica-

tions do not exceed N + K<sub>2</sub>O guidelines for fertilizer placed in direct seed contact.

### Phosphorus Sufficiency Recommendations

| Mehlich-3 P<br>Soil Test<br>(ppm) | Category  | Expected Yield (ton/a) |    |    |    |    |
|-----------------------------------|-----------|------------------------|----|----|----|----|
|                                   |           | 10                     | 15 | 20 | 25 | 30 |
| 0 – 8                             | Very Low  | 50                     | 55 | 60 | 60 | 65 |
| 9 – 15                            | Low       | 25                     | 25 | 30 | 30 | 35 |
| 16 – 20                           | Medium    | 15                     | 15 | 15 | 15 | 15 |
| 21 – 30                           | High      | 0                      | 0  | 0  | 0  | 0  |
| 31+                               | Very High | 0                      | 0  | 0  | 0  | 0  |

$$\text{Phosphorus Build-Maintenance Rec} = \left\{ \frac{(20 - \text{Current P Soil Test}) \times 18}{\text{Years To Build}} \right\} + \text{P}_2\text{O}_5 \text{ Removal In Crop}$$

The goal of the initial phase is to build the soil test value to the critical soil test value (CSTV) of 20 ppm, and subsequently maintain it within the range of 20 to 30 ppm through crop removal replacement. The quantity of P<sub>2</sub>O<sub>5</sub> fertilizer required to elevate the soil test P value differs according to soil type, in addition to differences in P removal and cycling, therefore regular soil sampling is necessary to keep track of soil test levels.

Four-, six-, and eight-year time frames below are examples only. Build programs can be over longer time frames, however, build-maintenance recommendations should not be less than crop sufficiency-based fertility programs.

### Phosphorus Build-Maintenance Recommendations

| Mehlich-3 P<br>Soil Test<br>(ppm) | Category  | 4-Year Build Time Frame,<br>Expected Yield (ton/a) |     |     | 6-Year Build Time Frame,<br>Expected Yield (ton/a) |     |     | 8-Year Build Time Frame,<br>Expected Yield (ton/a) |     |     |
|-----------------------------------|-----------|--|-----|-----|--|-----|-----|--|-----|-----|
|                                   |           | 10   | 20  | 30  | 10   | 20  | 30  | 10   | 20  | 30  |
| 0 – 8                             | Very Low  | 104  | 136 | 168 | 80   | 112 | 144 | 68   | 100 | 132 |
| 9 – 15                            | Low       | 68   | 100 | 132 | 56   | 88  | 120 | 50   | 82  | 114 |
| 16 – 20                           | Medium    | 41   | 73  | 105 | 38   | 70  | 102 | 37   | 69  | 101 |
| 21 – 30*                          | High      | 32   | 64  | 96  | 32   | 64  | 96  | 32   | 64  | 96  |
| 30+                               | Very High | 0  | 0   | 0   | 0  | 0   | 0   | 0  | 0   | 0   |

\*Recommended amounts of P<sub>2</sub>O<sub>5</sub> are based on crop nutrient removal only.

# Phosphorus Recommendations

## Brome and Fescue

$$\text{Brome/Fescue Sufficiency P Rec} = [44 + (6.3 \times \text{Expected Yield}) + (\text{Mehlich-3 P} \times -2.2) + (\text{Expected Yield} \times \text{Mehlich-3 P} \times -0.315)]$$

The P recommendations are for the total amount of broadcast and banded nutrients to be applied. If Mehlich-3 P is greater than 20 ppm, then basic P recommendation is zero. If Mehlich-3 P is less than 20 ppm, then the minimum P recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

### Phosphorus Sufficiency Recommendations

| Mehlich-3 P<br>Soil Test | Category  | Expected Yield (ton/a)                          |    |    |    |    |
|--------------------------|-----------|---|----|----|----|----|
|                          |           | 2   | 3  | 4  | 5  | 6  |
| (ppm)                    |           | ----- lb P <sub>2</sub> O <sub>5</sub> /a ----- |    |    |    |    |
| 0 – 8                    | Very Low  | 45  | 50 | 55 | 60 | 65 |
| 9 – 15                   | Low       | 25  | 25 | 30 | 30 | 35 |
| 16 – 20                  | Medium    | 15  | 15 | 15 | 15 | 15 |
| 21 – 30                  | High      | 0   | 0  | 0  | 0  | 0  |
| 31+                      | Very High | 0   | 0  | 0  | 0  | 0  |

## New Brome and Fescue

$$\text{New Brome/Fescue Sufficiency P Rec} = [68 + (11.2 \times \text{Expected Yield}) + (\text{Mehlich-3 P} \times -3.4) + (\text{Expected Yield} \times \text{Mehlich-3 P} \times -0.56)]$$

The P recommendations are for the total amount of broadcast and banded nutrients to be applied. If Mehlich-3 P is greater than 20 ppm, then basic P recommendation is zero. If Mehlich-3 P is less than 20 ppm, then the minimum P recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

### Phosphorus Sufficiency Recommendations

| Mehlich-3 P<br>Soil Test | Category  | Expected Yield (ton/a)                          |     |    |     |    |
|--------------------------|-----------|---|-----|----|-----|----|
|                          |           | 2   | 2.5 | 3  | 3.5 | 4  |
| (ppm)                    |           | ----- lb P <sub>2</sub> O <sub>5</sub> /a ----- |     |    |     |    |
| 0 – 8                    | Very Low  | 70  | 75  | 80 | 85  | 90 |
| 9 – 15                   | Low       | 35  | 40  | 40 | 45  | 45 |
| 16 – 20                  | Medium    | 15  | 15  | 15 | 15  | 15 |
| 21 – 30                  | High      | 0   | 0   | 0  | 0   | 0  |
| 31+                      | Very High | 0   | 0   | 0  | 0   | 0  |

# Phosphorus Recommendations

## Bermudagrass

$$\text{Bermuda Sufficiency P Rec} = [64 + (5.3 \times \text{Expected Yield}) + (\text{Mehlich-3 P} \times -2.56) + (\text{Expected Yield} \times \text{Mehlich-3 P} \times -0.21)]$$

The P recommendations are for the total amount of broadcast and banded nutrients to be applied. If Mehlich-3 P is greater than 25 ppm, then basic P recommendation is zero. If Mehlich-3 P is less than 25 ppm, then the minimum P recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

### Phosphorus Sufficiency Recommendations

| Mehlich-3 P<br>Soil Test | Category  | Expected Yield (ton/a)                          |    |    |    |     |
|--------------------------|-----------|---|----|----|----|-----|
|                          |           | 2   | 4  | 6  | 8  | 10  |
| (ppm)                    |           | ----- lb P <sub>2</sub> O <sub>5</sub> /a ----- |    |    |    |     |
| 0 – 8                    | Very Low  | 65  | 70 | 80 | 90 | 100 |
| 9 – 16                   | Low       | 35  | 45 | 50 | 55 | 60  |
| 17 – 25                  | Medium    | 15  | 15 | 15 | 15 | 20  |
| 26 – 35                  | High      | 0   | 0  | 0  | 0  | 0   |
| 36+                      | Very High | 0   | 0  | 0  | 0  | 0   |

## New Bermudagrass

$$\text{Bermuda Sufficiency P Rec} = [64 + (9.1 \times \text{Expected Yield}) + (\text{Mehlich-3 P} \times -2.56) + (\text{Expected Yield} \times \text{Mehlich-3 P} \times -0.365)]$$

The P recommendations are for the total amount of broadcast and banded nutrients to be applied. If Mehlich-3 P is greater than 25 ppm, then basic P recommendation is zero. If Mehlich-3 P is less than 25 ppm, then the minimum P recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

### Phosphorus Sufficiency Recommendations

| Mehlich-3 P<br>Soil Test | Category  | Expected Yield (ton/a)                          |    |    |    |     |
|--------------------------|-----------|---|----|----|----|-----|
|                          |           | 2   | 3  | 4  | 5  | 6   |
| (ppm)                    |           | ----- lb P <sub>2</sub> O <sub>5</sub> /a ----- |    |    |    |     |
| 0 – 8                    | Very Low  | 70  | 75 | 85 | 90 | 100 |
| 9 – 16                   | Low       | 40  | 45 | 50 | 55 | 60  |
| 17 – 25                  | Medium    | 15  | 15 | 15 | 15 | 20  |
| 26 – 35                  | High      | 0   | 0  | 0  | 0  | 0   |
| 36+                      | Very High | 0   | 0  | 0  | 0  | 0   |

# Phosphorus Recommendations

## Alfalfa and Clover

$$\text{Alfalfa/Clover Sufficiency P Rec} = [73 + (4.56 \times \text{Expected Yield}) + (\text{Mehlich-3 P} \times -2.92) + (\text{Expected Yield} \times \text{Mehlich-3 P} \times -0.18)]$$

Crop P recommendations are for the total amount of broadcast and banded nutrients to be applied. Nitrogen fertilizer is not recommended for established alfalfa and clover, however, the amount of N supplied by common P fertilizers is not detrimental to production.

If Mehlich-3 P is greater than 25 ppm, then the basic P recommendation is zero. If Mehlich-3 P is less than 25 ppm, then the minimum P recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

### Phosphorus Sufficiency Recommendations

| Mehlich-3 P<br>Soil Test | Category  | Expected Yield (ton/a)                          |    |    |    |     |
|--------------------------|-----------|---|----|----|----|-----|
|                          |           | 2   | 4  | 6  | 8  | 10  |
| (ppm)                    |           | ----- lb P <sub>2</sub> O <sub>5</sub> /a ----- |    |    |    |     |
| 0 – 8                    | Very Low  | 70  | 75 | 85 | 90 | 100 |
| 9 – 16                   | Low       | 40  | 45 | 50 | 55 | 60  |
| 17 – 25                  | Medium    | 15  | 15 | 15 | 20 | 20  |
| 26 – 35                  | High      | 0   | 0  | 0  | 0  | 0   |
| 36+                      | Very High | 0   | 0  | 0  | 0  | 0   |

$$\text{Phosphorus Build-Maintenance Rec} = \left\{ \frac{(25 - \text{Current P Soil Test}) \times 18}{\text{Years To Build}} \right\} + \text{P}_2\text{O}_5 \text{ Removal In Crop}$$

The goal of the initial phase is to build the soil test value to the critical soil test value (CSTV) of 25 ppm, and subsequently maintain it within the range of 25 to 35 ppm through crop removal replacement. The quantity of P<sub>2</sub>O<sub>5</sub> fertilizer required to elevate the soil test P value differs according to soil type, in addition to differences in P removal and cycling, therefore regular soil sampling is necessary to keep track of soil test levels.

Four-, six-, and eight-year time frames below are examples only. Build programs can be over longer time frames, however, build-maintenance recommendations should not be less than crop sufficiency-based fertility programs.

### Phosphorus Build-Maintenance Recommendations

| Mehlich-3 P<br>Soil Test | Category  | 4-Year Build Time Frame,<br>Expected Yield (ton/a) |     |     | 6-Year Build Time Frame,<br>Expected Yield (ton/a) |     |     | 8-Year Build Time Frame,<br>Expected Yield (ton/a) |     |     |
|--------------------------|-----------|--|-----|-----|--|-----|-----|--|-----|-----|
|                          |           | 2  | 6   | 10  | 2  | 6   | 10  | 2  | 6   | 10  |
| (ppm)                    |           | ----- lb P <sub>2</sub> O <sub>5</sub> /a -----    |     |     | ----- lb P <sub>2</sub> O <sub>5</sub> /a -----    |     |     | ----- lb P <sub>2</sub> O <sub>5</sub> /a -----    |     |     |
| 0 – 8                    | Very Low  | 119  | 167 | 215 | 87   | 135 | 183 | 71   | 119 | 167 |
| 9 – 16                   | Low       | 80   | 128 | 176 | 62   | 110 | 158 | 52   | 100 | 148 |
| 17 – 25                  | Medium    | 42   | 90  | 138 | 36   | 84  | 132 | 33   | 81  | 129 |
| 26 – 35*                 | High      | 24   | 72  | 120 | 24   | 72  | 120 | 24   | 72  | 120 |
| 36+                      | Very High | 0  | 0   | 0   | 0  | 0   | 0   | 0  | 0   | 0   |

\*Recommended amounts of P<sub>2</sub>O<sub>5</sub> are based on crop nutrient removal only.

# Phosphorus Recommendations

## New Alfalfa and Clover

$$\text{New Alfalfa/Clover Sufficiency P Rec} = [84 + (12 \times \text{Expected Yield}) + (\text{Mehlich-3 P} \times -3.37) + (\text{Expected Yield} \times \text{Mehlich-3 P} \times -0.48)]$$

Crop P recommendations are for the total amount of broadcast and banded nutrients to be applied. If Mehlich-3 P is greater than 25 ppm, then the basic P recommendation is zero. If Mehlich-3 P is less than 25 ppm, then the minimum P recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a. A small amount of nitrogen fertilizer (15 to 20 lb/a) preplant can be beneficial for new alfalfa establishment.

### Phosphorus Sufficiency Recommendations

| Mehlich-3 P<br>Soil Test | Category  | Expected Yield (ton/a)                          |     |     |     |     |
|--------------------------|-----------|---|-----|-----|-----|-----|
|                          |           | 2   | 3   | 4   | 5   | 6   |
| (ppm)                    |           | ----- lb P <sub>2</sub> O <sub>5</sub> /a ----- |     |     |     |     |
| 0 – 8                    | Very Low  | 90  | 100 | 110 | 120 | 130 |
| 9 – 16                   | Low       | 55  | 60  | 65  | 70  | 80  |
| 17 – 25                  | Medium    | 15  | 20  | 20  | 25  | 25  |
| 26 – 35                  | High      | 0   | 0   | 0   | 0   | 0   |
| 36+                      | Very High | 0   | 0   | 0   | 0   | 0   |

# Potassium Recommendations

## Corn

$$\text{Corn Sufficiency K Rec} = [73 + (\text{Expected Yield} \times 0.21) + (\text{Extractable K} \times -0.565) + (\text{Expected Yield} \times \text{Extractable K} \times -0.0016)]$$

Crop K recommendations are for the total amount of broadcast and banded nutrients to be applied. If soil extractable K is greater than 130 ppm, then only NPK or NPKS starter fertilizer is suggested. If extractable K is less than 130 ppm, then the minimum K recommendation is 15 lb K<sub>2</sub>O/a. For in-furrow starter fertilizer do not exceed N + K<sub>2</sub>O guidelines for fertilizer placed in direct seed contact.

### Potassium Sufficiency Recommendations

| Extractable K<br>Soil Test | Category  | Expected Yield (bu/a)            |     |     |     |     |
|----------------------------|-----------|----------------------------------|-----|-----|-----|-----|
|                            |           | 80                               | 120 | 160 | 200 | 240 |
| (ppm)                      |           | -----lb K <sub>2</sub> O/a ----- |     |     |     |     |
| 0 – 40                     | Very Low  | 75                               | 85  | 90  | 95  | 105 |
| 41 – 80                    | Low       | 50                               | 50  | 55  | 60  | 65  |
| 81 – 130                   | Medium    | 15                               | 20  | 20  | 20  | 25  |
| 131 – 160                  | High      | 0                                | 0   | 0   | 0   | 0   |
| 161+                       | Very High | 0                                | 0   | 0   | 0   | 0   |

$$\text{Potassium Build-Maintenance Rec} = \left\{ \frac{(130 - \text{Current K Soil Test}) \times 9}{\text{Years To Build}} \right\} + \text{K}_2\text{O Removal In Crop}$$

The goal of the initial phase is to build the soil test value to the critical soil test value (CSTV) of 130 ppm, and subsequently maintain it within the range of 130 to 160 ppm through crop removal replacement. The quantity of K<sub>2</sub>O fertilizer required to elevate the soil test K value differs according to soil type, in addition to differences in K crop removal, cycling to the soil and soil-K interaction, therefore regular soil sampling is necessary to keep track of soil test levels.

Four-, six-, and eight-year time frames below are examples only. Build programs can be over longer time frames, however, build-maintenance recommendations should not be less than crop sufficiency-based fertility programs.

### Potassium Build-Maintenance Recommendations

| Extractable K<br>Soil Test | Category  | 4-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     | 6-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     | 8-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     |
|----------------------------|-----------|---|-----|-----|---|-----|-----|---|-----|-----|
|                            |           | 80  | 160 | 240 | 80  | 160 | 240 | 80  | 160 | 240 |
| (ppm)                      |           | ----- lb K <sub>2</sub> O/a -----                 |     |     | ----- lb K <sub>2</sub> O/a -----                 |     |     | ----- lb K <sub>2</sub> O/a -----                 |     |     |
| 0 – 40                     | Very Low  | 268   | 289 | 310 | 186   | 207 | 227 | 145   | 165 | 186 |
| 41 – 80                    | Low       | 177   | 198 | 219 | 125   | 146 | 167 | 99  | 120 | 141 |
| 81 – 130                   | Medium    | 76  | 97  | 118 | 58  | 78  | 99  | 48  | 69  | 90  |
| 131 – 160*                 | High      | 21  | 42  | 62  | 21  | 42  | 62  | 21  | 42  | 62  |
| 161+                       | Very High | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

\*Recommended amounts of K<sub>2</sub>O are based on crop nutrient removal only.

# Potassium Recommendations

## Wheat

$$\text{Wheat Sufficiency K Rec} = [62 + (\text{Expected Yield} \times 0.24) + (\text{Extractable K} \times -0.48) + (\text{Expected Yield} \times \text{Extractable K} \times -0.0018)]$$

Crop K recommendations are for the total amount of broadcast and banded nutrients to be applied. If soil extractable K is greater than 130 ppm, then only NPK or NPKS starter fertilizer is suggested. If extractable K is less than 130 ppm, then the minimum K recommendation is 15 lb K<sub>2</sub>O/a. For in-furrow starter fertilizer do not exceed N + K<sub>2</sub>O guidelines for fertilizer placed in direct seed contact.

### Potassium Sufficiency Recommendations

| Extractable K<br>Soil Test | Category  | Expected Yield (bu/a)            |    |    |    |    |
|----------------------------|-----------|----------------------------------|----|----|----|----|
|                            |           | 30                               | 40 | 50 | 60 | 70 |
| (ppm)                      |           | -----lb K <sub>2</sub> O/a ----- |    |    |    |    |
| 0 – 40                     | Very Low  | 60                               | 60 | 65 | 65 | 65 |
| 41 – 80                    | Low       | 35                               | 40 | 40 | 40 | 40 |
| 81 – 130                   | Medium    | 15                               | 15 | 15 | 15 | 15 |
| 131 – 160                  | High      | 0                                | 0  | 0  | 0  | 0  |
| 161+                       | Very High | 0                                | 0  | 0  | 0  | 0  |

$$\text{Potassium Build-Maintenance Rec} = \left\{ \frac{(130 - \text{Current K Soil Test}) \times 9}{\text{Years To Build}} \right\} + \text{K}_2\text{O Removal In Crop}$$

The goal of the initial phase is to build the soil test value to the critical soil test value (CSTV) of 130 ppm, and subsequently maintain it within the range of 130 to 160 ppm through crop removal replacement. The quantity of K<sub>2</sub>O fertilizer required to elevate the soil test K value differs according to soil type, in addition to differences in K crop removal, cycling to the soil and soil-K interaction, therefore regular soil sampling is necessary to keep track of soil test levels.

Four-, six-, and eight-year time frames below are examples only. Build programs can be over longer time frames, however, build-maintenance recommendations should not be less than crop sufficiency-based fertility programs.

### Potassium Build-Maintenance Recommendations

| Extractable K<br>Soil Test | Category  | 4-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     | 6-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     | 8-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     |
|----------------------------|-----------|---|-----|-----|---|-----|-----|---|-----|-----|
|                            |           | 30  | 50  | 70  | 30  | 50  | 70  | 30  | 50  | 70  |
| (ppm)                      |           | ----- lb K <sub>2</sub> O/a -----                 |     |     | ----- lb K <sub>2</sub> O/a -----                 |     |     | ----- lb K <sub>2</sub> O/a -----                 |     |     |
| 0 – 40                     | Very Low  | 257   | 263 | 269 | 174   | 180 | 186 | 133   | 139 | 145 |
| 41 – 80                    | Low       | 165   | 171 | 177 | 113   | 119 | 125 | 87  | 93  | 99  |
| 81 – 130                   | Medium    | 64  | 70  | 76  | 46  | 52  | 58  | 37  | 43  | 49  |
| 131 – 160*                 | High      | 9   | 15  | 21  | 9   | 15  | 21  | 9   | 15  | 21  |
| 161+                       | Very High | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

\*Recommended amounts of K<sub>2</sub>O are based on crop nutrient removal only.

# Potassium Recommendations

## Grain Sorghum

$$\text{Grain Sorghum Sufficiency K Rec} = [80 + (0.17 \times \text{Expected Yield}) + (\text{Extractable K} \times -0.616) + (\text{Expected Yield} \times \text{Extractable K} \times -0.0013)]$$

Crop K recommendations are for the total amount of broadcast and banded nutrients to be applied. If soil extractable K is greater than 130 ppm, then only NPK or NPKS starter fertilizer is suggested. If extractable K is less than 130 ppm, then the minimum K recommendation is 15 lb K<sub>2</sub>O/a. For in-furrow starter fertilizer do not exceed N + K<sub>2</sub>O guidelines for fertilizer placed in direct seed contact.

### Potassium Sufficiency Recommendations

| Extractable K<br>Soil Test | Category  | Expected Yield (bu/a)            |    |     |     |     |
|----------------------------|-----------|----------------------------------|----|-----|-----|-----|
|                            |           | 40                               | 80 | 120 | 160 | 200 |
| (ppm)                      |           | -----lb K <sub>2</sub> O/a ----- |    |     |     |     |
| 0 – 40                     | Very Low  | 75                               | 80 | 90  | 95  | 100 |
| 41 – 80                    | Low       | 55                               | 60 | 60  | 65  | 70  |
| 81 – 130                   | Medium    | 30                               | 30 | 35  | 35  | 35  |
| 131 – 160                  | High      | 0                                | 0  | 0   | 0   | 0   |
| 161+                       | Very High | 0                                | 0  | 0   | 0   | 0   |

$$\text{Potassium Build-Maintenance Rec} = \left\{ \frac{(130 - \text{Current K Soil Test}) \times 9}{\text{Years To Build}} \right\} + \text{K}_2\text{O Removal In Crop}$$

The goal of the initial phase is to build the soil test value to the critical soil test value (CSTV) of 130 ppm, and subsequently maintain it within the range of 130 to 160 ppm through crop removal replacement. The quantity of K<sub>2</sub>O fertilizer required to elevate the soil test K value differs according to soil type, in addition to differences in K crop removal, cycling to the soil and soil-K interaction, therefore regular soil sampling is necessary to keep track of soil test levels.

Four-, six-, and eight-year time frames below are examples only. Build programs can be over longer time frames, however, build-maintenance recommendations should not be less than crop sufficiency-based fertility programs.

### Potassium Build-Maintenance Recommendations

| Extractable K<br>Soil Test | Category  | 4-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     | 6-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     | 8-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     |
|----------------------------|-----------|---|-----|-----|---|-----|-----|---|-----|-----|
|                            |           | 40  | 120 | 200 | 40  | 120 | 200 | 40  | 120 | 200 |
| (ppm)                      |           | ----- lb K <sub>2</sub> O/a -----                 |     |     | ----- lb K <sub>2</sub> O/a -----                 |     |     | ----- lb K <sub>2</sub> O/a -----                 |     |     |
| 0 – 40                     | Very Low  | 258   | 279 | 300 | 175   | 196 | 217 | 134   | 155 | 176 |
| 41 – 80                    | Low       | 167   | 188 | 208 | 115   | 135 | 156 | 89  | 109 | 130 |
| 81 – 130                   | Medium    | 66  | 86  | 107 | 47  | 68  | 89  | 38  | 59  | 80  |
| 131 – 160*                 | High      | 10  | 31  | 52  | 10  | 31  | 52  | 10  | 31  | 52  |
| 161+                       | Very High | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

\*Recommended amounts of K<sub>2</sub>O are based on crop nutrient removal only.

# Potassium Recommendations

## Soybean

$$\text{Soybeans Sufficiency K Rec} = [ 60 + (0.628 \times \text{Expected Yield}) + (\text{Extractable K} \times -0.46) + (\text{Expected Yield} \times \text{Extractable K} \times -0.0048) ]$$

Crop K recommendations are for the total amount of broadcast and banded nutrients to be applied. If soil extractable K is greater than 130 ppm, then only NPK or NPKS starter fertilizer is suggested. If extractable K is less than 130 ppm, then the minimum K recommendation is 15 lb K<sub>2</sub>O/a. Soybean seedlings are particularly sensitive to fertilizer damage, and fertilizer placed in direct seed contact is not recommended.

### Potassium Sufficiency Recommendations

| Extractable K<br>Soil Test | Category  | Expected Yield (bu/a)            |    |    |    |    |
|----------------------------|-----------|----------------------------------|----|----|----|----|
|                            |           | 30                               | 40 | 50 | 60 | 70 |
| (ppm)                      |           | -----lb K <sub>2</sub> O/a ----- |    |    |    |    |
| 0 – 40                     | Very Low  | 65                               | 70 | 75 | 85 | 90 |
| 41 – 80                    | Low       | 40                               | 45 | 50 | 50 | 55 |
| 81 – 130                   | Medium    | 15                               | 15 | 20 | 20 | 20 |
| 131 – 160                  | High      | 0                                | 0  | 0  | 0  | 0  |
| 161+                       | Very High | 0                                | 0  | 0  | 0  | 0  |

$$\text{Potassium Build-Maintenance Rec} = \left\{ \frac{(130 - \text{Current K Soil Test}) \times 9}{\text{Years To Build}} \right\} + \text{K}_2\text{O Removal In Crop}$$

The goal of the initial phase is to build the soil test value to the critical soil test value (CSTV) of 130 ppm, and subsequently maintain it within the range of 130 to 160 ppm through crop removal replacement. The quantity of K<sub>2</sub>O fertilizer required to elevate the soil test K value differs according to soil type, in addition to differences in K crop removal, cycling to the soil and soil-K interaction, therefore regular soil sampling is necessary to keep track of soil test levels.

Four-, six-, and eight-year time frames below are examples only. Build programs can be over longer time frames, however, build-maintenance recommendations should not be less than crop sufficiency-based fertility programs.

### Potassium Build-Maintenance Recommendations

| Extractable K<br>Soil Test | Category  | 4-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     | 6-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     | 8-Year Build Time Frame,<br>Expected Yield (bu/a) |     |     |
|----------------------------|-----------|---|-----|-----|---|-----|-----|---|-----|-----|
|                            |           | 30  | 50  | 70  | 30  | 50  | 70  | 30  | 50  | 70  |
| (ppm)                      |           | ----- lb K <sub>2</sub> O/a -----                 |     |     | ----- lb K <sub>2</sub> O/a -----                 |     |     | ----- lb K <sub>2</sub> O/a -----                 |     |     |
| 0 – 40                     | Very Low  | 290   | 318 | 346 | 207   | 235 | 263 | 166   | 194 | 222 |
| 41 – 80                    | Low       | 198   | 226 | 254 | 146   | 174 | 202 | 120   | 148 | 176 |
| 81 – 130                   | Medium    | 97  | 125 | 153 | 79  | 107 | 135 | 70  | 98  | 126 |
| 131 – 160*                 | High      | 42  | 70  | 98  | 42  | 70  | 98  | 42  | 70  | 98  |
| 161+                       | Very High | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

\*Recommended amounts of K<sub>2</sub>O are based on crop nutrient removal only.

# Potassium Recommendations

## Sunflower

$$\text{Sunflower Sufficiency K Rec} = [80 + (\text{Expected Yield} \times 0.008) + (\text{Extractable K} \times -0.622) + (\text{Expected Yield} \times \text{Extractable K} \times -0.00006)]$$

Crop K recommendations are for the total amount of broadcast and banded nutrients to be applied. If soil extractable K is greater than 130 ppm, then only NPK or NPKS starter fertilizer is suggested. If extractable K is less than 130 ppm, then the minimum K recommendation is 15 lb K<sub>2</sub>O/a. For in-furrow starter fertilizer do not exceed N + K<sub>2</sub>O guidelines for fertilizer placed in direct seed contact.

### Potassium Sufficiency Recommendations

| Extractable K Soil Test (ppm) | Category  | Expected Yield (lb/a) |       |       |       |       |
|-------------------------------|-----------|-----------------------|-------|-------|-------|-------|
|                               |           | 1,000                 | 1,500 | 2,000 | 2,500 | 3,000 |
| 0 – 40                        | Very Low  | 75                    | 80    | 80    | 85    | 90    |
| 41 – 80                       | Low       | 45                    | 50    | 50    | 55    | 55    |
| 81 – 130                      | Medium    | 15                    | 15    | 20    | 20    | 20    |
| 131 – 160                     | High      | 0                     | 0     | 0     | 0     | 0     |
| 161+                          | Very High | 0                     | 0     | 0     | 0     | 0     |

$$\text{Potassium Build-Maintenance Rec} = \left\{ \frac{(130 - \text{Current K Soil Test}) \times 9}{\text{Years To Build}} \right\} + \text{K}_2\text{O Removal In Crop}$$

The goal of the initial phase is to build the soil test value to the critical soil test value (CSTV) of 130 ppm, and subsequently maintain it within the range of 130 to 160 ppm through crop removal replacement. The quantity of K<sub>2</sub>O fertilizer required to elevate the soil test K value differs according to soil type, in addition to differences in K crop removal, cycling to the soil and soil-K interaction, therefore regular soil sampling is necessary to keep track of soil test levels.

Four-, six-, and eight-year time frames below are examples only. Build programs can be over longer time frames, however, build-maintenance recommendations should not be less than crop sufficiency-based fertility programs.

### Potassium Build-Maintenance Recommendations

| Extractable K Soil Test (ppm) | Category  | 4-Year Build Time Frame, Expected Yield (lb/a) |       |       | 6-Year Build Time Frame, Expected Yield (lb/a) |       |       | 8-Year Build Time Frame, Expected Yield (lb/a) |       |       |
|-------------------------------|-----------|--|-------|-------|--|-------|-------|--|-------|-------|
|                               |           | 1,000  | 2,000 | 3,000 | 1,000  | 2,000 | 3,000 | 1,000  | 2,000 | 3,000 |
| 0 – 40                        | Very Low  | 254  | 260   | 266   | 171  | 177   | 183   | 130  | 136   | 142   |
| 41 – 80                       | Low       | 162  | 168   | 174   | 110  | 116   | 122   | 84   | 90    | 96    |
| 81 – 130                      | Medium    | 61   | 67    | 73    | 43   | 49    | 55    | 34   | 40    | 46    |
| 131 – 160*                    | High      | 6  | 12    | 18    | 6  | 12    | 18    | 6  | 12    | 18    |
| 161+                          | Very High | 0  | 0     | 0     | 0  | 0     | 0     | 0  | 0     | 0     |

\*Recommended amounts of K<sub>2</sub>O are based on crop nutrient removal only.

# Potassium Recommendations

## Oats

$$\text{Oats Sufficiency K Rec} = [62 + (\text{Expected Yield} \times 0.221) + (\text{Extractable K} \times -0.48) + (\text{Expected Yield} \times \text{Extractable K} \times -0.0017)]$$

Crop K recommendations are for the total amount of broadcast and banded nutrients to be applied. If soil extractable K is greater than 130 ppm, then only NPK or NPKS starter fertilizer is suggested. If extractable K is less than 130 ppm, then the minimum K recommendation is 15 lb K<sub>2</sub>O/a. For in-furrow starter fertilizer do not exceed N + K<sub>2</sub>O guidelines for fertilizer placed in direct seed contact.

### Potassium Sufficiency Recommendations

| Extractable K Soil Test (ppm) | Category  | Expected Yield (bu/a) |    |     |     |     |
|-------------------------------|-----------|-----------------------|----|-----|-----|-----|
|                               |           | 60                    | 80 | 100 | 120 | 140 |
| 0 – 40                        | Very Low  | 65                    | 65 | 70  | 75  | 80  |
| 41 – 80                       | Low       | 40                    | 40 | 45  | 45  | 50  |
| 81 – 130                      | Medium    | 15                    | 15 | 15  | 15  | 15  |
| 131 – 160                     | High      | 0                     | 0  | 0   | 0   | 0   |
| 161+                          | Very High | 0                     | 0  | 0   | 0   | 0   |

$$\text{Potassium Build-Maintenance Rec} = \left\{ \frac{(130 - \text{Current K Soil Test}) \times 9}{\text{Years To Build}} \right\} + \text{K}_2\text{O Removal In Crop}$$

The goal of the initial phase is to build the soil test value to the critical soil test value (CSTV) of 130 ppm, and subsequently maintain it within the range of 130 to 160 ppm through crop removal replacement. The quantity of K<sub>2</sub>O fertilizer required to elevate the soil test K value differs according to soil type, in addition to differences in K crop removal, cycling to the soil and soil-K interaction, therefore regular soil sampling is necessary to keep track of soil test levels.

Four-, six-, and eight-year time frames below are examples only. Build programs can be over longer time frames, however, build-maintenance recommendations should not be less than crop sufficiency-based fertility programs.

### Potassium Build-Maintenance Oats Recommendations

| Extractable K Soil Test (ppm) | Category  | 4-Year Build Time Frame, Expected Yield (bu/a) |     |     | 6-Year Build Time Frame, Expected Yield (bu/a) |     |     | 8-Year Build Time Frame, Expected Yield (bu/a) |     |     |
|-------------------------------|-----------|--|-----|-----|--|-----|-----|--|-----|-----|
|                               |           | 60   | 100 | 140 | 60   | 100 | 140 | 60   | 100 | 140 |
| 0 – 40                        | Very Low  | 260  | 268 | 276 | 177  | 185 | 193 | 136  | 144 | 152 |
| 41 – 80                       | Low       | 168  | 176 | 184 | 116  | 124 | 132 | 90   | 98  | 106 |
| 81 – 130                      | Medium    | 67   | 75  | 83  | 49   | 57  | 65  | 40   | 48  | 56  |
| 131 – 160*                    | High      | 12   | 20  | 28  | 12   | 20  | 28  | 12   | 20  | 28  |
| 161+                          | Very High | 0  | 0   | 0   | 0  | 0   | 0   | 0  | 0   | 0   |

\*Recommended amounts of K<sub>2</sub>O are based on crop nutrient removal only.

# Potassium Recommendations

## Corn Silage

$$\text{Corn Silage Sufficiency K Rec} = [74 + (\text{Expected Yield} \times 1.50) + (\text{Extractable K} \times -0.567) + (\text{Expected Yield} \times \text{Extractable K} \times -0.0115)]$$

Crop K recommendations are for the total amount of broadcast and banded nutrients to be applied. If soil extractable K is greater than 130 ppm, then only NPK or NPKS starter fertilizer is suggested. If extractable K is less than 130 ppm, then the minimum K recommendation is 15 lb K<sub>2</sub>O/a. For in-furrow starter fertilizer do not exceed N + K<sub>2</sub>O guidelines for fertilizer placed in direct seed contact.

### Potassium Sufficiency Recommendations

| Extractable K<br>Soil Test | Category  | Expected Yield (ton/a)           |    |    |    |     |
|----------------------------|-----------|----------------------------------|----|----|----|-----|
|                            |           | 10                               | 15 | 20 | 25 | 30  |
| (ppm)                      |           | -----lb K <sub>2</sub> O/a ----- |    |    |    |     |
| 0 – 40                     | Very Low  | 75                               | 80 | 90 | 95 | 100 |
| 41 – 80                    | Low       | 50                               | 50 | 55 | 60 | 65  |
| 81 – 130                   | Medium    | 15                               | 20 | 20 | 20 | 25  |
| 131 – 160                  | High      | 0                                | 0  | 0  | 0  | 0   |
| 161+                       | Very High | 0                                | 0  | 0  | 0  | 0   |

$$\text{Potassium Build-Maintenance Rec} = \left\{ \frac{(130 - \text{Current K Soil Test}) \times 9}{\text{Years To Build}} \right\} + \text{K}_2\text{O Removal In Crop}$$

The goal of the initial phase is to build the soil test value to the critical soil test value (CSTV) of 130 ppm, and subsequently maintain it within the range of 130 to 160 ppm through crop removal replacement. The quantity of K<sub>2</sub>O fertilizer required to elevate the soil test K value differs according to soil type, in addition to differences in K crop removal, cycling to the soil and soil-K interaction, therefore regular soil sampling is necessary to keep track of soil test levels.

Four-, six-, and eight-year time frames below are examples only. Build programs can be over longer time frames, however, build-maintenance recommendations should not be less than crop sufficiency-based fertility programs.

### Potassium Build-Maintenance Recommendations

| Extractable K<br>Soil Test | Category  | 4-Year Build Time Frame,<br>Expected Yield (ton/a) |     |     | 6-Year Build Time Frame,<br>Expected Yield (ton/a) |     |     | 8-Year Build Time Frame,<br>Expected Yield (ton/a) |     |     |
|----------------------------|-----------|--|-----|-----|--|-----|-----|--|-----|-----|
|                            |           | 10   | 20  | 30  | 10   | 20  | 30  | 10   | 20  | 30  |
| (ppm)                      |           | ----- lb K <sub>2</sub> O/a -----                  |     |     | ----- lb K <sub>2</sub> O/a -----                  |     |     | ----- lb K <sub>2</sub> O/a -----                  |     |     |
| 0 – 40                     | Very Low  | 335  | 422 | 509 | 252  | 339 | 426 | 211  | 298 | 385 |
| 41 – 80                    | Low       | 243  | 330 | 417 | 191  | 278 | 365 | 165  | 252 | 339 |
| 81 – 130                   | Medium    | 142  | 229 | 316 | 124  | 211 | 298 | 115  | 202 | 289 |
| 131 – 160*                 | High      | 87   | 174 | 261 | 87   | 174 | 261 | 87   | 174 | 261 |
| 161+                       | Very High | 0  | 0   | 0   | 0  | 0   | 0   | 0  | 0   | 0   |

\*Recommended amounts of K<sub>2</sub>O are based on crop nutrient removal only.

# Potassium Recommendations

## Sorghum Silage

$$\text{Sorghum Silage Sufficiency K Rec} = [73 + (1.8 \times \text{Expected Yield}) + (\text{Extractable K} \times -0.56) + (\text{Expected Yield} \times \text{Extractable K} \times -0.0139)]$$

Crop K recommendations are for the total amount of broadcast and banded nutrients to be applied. If soil extractable K is greater than 130 ppm, then only NPK or NPKS starter fertilizer is suggested. If extractable K is less than 130 ppm, then the minimum K recommendation is 15 lb K<sub>2</sub>O/a. For in-furrow starter fertilizer do not exceed N + K<sub>2</sub>O guidelines for fertilizer placed in direct seed contact.

### Potassium Sufficiency Recommendations

| Extractable K<br>Soil Test | Category  | Expected Yield (ton/a)           |    |    |     |     |
|----------------------------|-----------|----------------------------------|----|----|-----|-----|
|                            |           | 10                               | 15 | 20 | 25  | 30  |
| (ppm)                      |           | -----lb K <sub>2</sub> O/a ----- |    |    |     |     |
| 0 – 40                     | Very Low  | 75                               | 85 | 90 | 100 | 105 |
| 41 – 80                    | Low       | 50                               | 55 | 60 | 65  | 70  |
| 81 – 130                   | Medium    | 15                               | 20 | 20 | 20  | 25  |
| 131 – 160                  | High      | 0                                | 0  | 0  | 0   | 0   |
| 161+                       | Very High | 0                                | 0  | 0  | 0   | 0   |

$$\text{Potassium Build-Maintenance Rec} = \left\{ \frac{(130 - \text{Current K Soil Test}) \times 9}{\text{Years To Build}} \right\} + \text{K}_2\text{O Removal In Crop}$$

The goal of the initial phase is to build the soil test value to the critical soil test value (CSTV) of 130 ppm, and subsequently maintain it within the range of 130 to 160 ppm through crop removal replacement. The quantity of K<sub>2</sub>O fertilizer required to elevate the soil test K value differs according to soil type, in addition to differences in K crop removal, cycling to the soil and soil-K interaction, therefore regular soil sampling is necessary to keep track of soil test levels.

Four-, six-, and eight-year time frames below are examples only. Build programs can be over longer time frames, however, build-maintenance recommendations should not be less than crop sufficiency-based fertility programs.

### Potassium Build-Maintenance Recommendations

| Extractable K<br>Soil Test | Category  | 4-Year Build Time Frame,<br>Expected Yield (ton/a) |     |     | 6-Year Build Time Frame,<br>Expected Yield (ton/a) |     |     | 8-Year Build Time Frame,<br>Expected Yield (ton/a) |     |     |
|----------------------------|-----------|--|-----|-----|--|-----|-----|--|-----|-----|
|                            |           | 10   | 20  | 30  | 10   | 20  | 30  | 10   | 20  | 30  |
| (ppm)                      |           | ----- lb K <sub>2</sub> O/a -----                  |     |     | ----- lb K <sub>2</sub> O/a -----                  |     |     | ----- lb K <sub>2</sub> O/a -----                  |     |     |
| 0 – 40                     | Very Low  | 335  | 422 | 509 | 252  | 339 | 426 | 211  | 298 | 385 |
| 41 – 80                    | Low       | 243  | 330 | 417 | 191  | 278 | 365 | 165  | 252 | 339 |
| 81 – 130                   | Medium    | 142  | 229 | 316 | 124  | 211 | 298 | 115  | 202 | 289 |
| 131 – 160*                 | High      | 87   | 174 | 261 | 87   | 174 | 261 | 87   | 174 | 261 |
| 161+                       | Very High | 0  | 0   | 0   | 0  | 0   | 0   | 0  | 0   | 0   |

\*Recommended amounts of K<sub>2</sub>O are based on crop nutrient removal only.

# Potassium Recommendations

## Brome and Fescue

$$\text{Brome/Fescue Sufficiency K Rec} = [41 + (5.85 \times \text{Expected Yield}) + (\text{Extractable K} \times -0.315) + (\text{Expected Yield} \times \text{Extractable K} \times -0.045)]$$

The K recommendations are for the total amount of broadcast and banded nutrients to be applied. If extractable K is greater than 130 ppm, then basic K recommendation is zero. If extractable K is less than 130 ppm, then the minimum K recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

### Potassium Sufficiency Recommendations

| Extractable K<br>Soil Test | Category  | Expected Yield (ton/a)           |    |    |    |    |
|----------------------------|-----------|----------------------------------|----|----|----|----|
|                            |           | 2                                | 3  | 4  | 5  | 6  |
| (ppm)                      |           | -----lb K <sub>2</sub> O/a ----- |    |    |    |    |
| 0 – 40                     | Very Low  | 45                               | 50 | 55 | 60 | 65 |
| 41 – 80                    | Low       | 30                               | 30 | 35 | 40 | 40 |
| 81 – 130                   | Medium    | 15                               | 15 | 15 | 15 | 15 |
| 131 – 160                  | High      | 0                                | 0  | 0  | 0  | 0  |
| 161+                       | Very High | 0                                | 0  | 0  | 0  | 0  |

## New Brome and Fescue

$$\text{New Brome/Fescue Sufficiency K Rec} = [91 + (15 \times \text{Expected Yield}) + (\text{Extractable K} \times -0.7) + (\text{Expected Yield} \times \text{Extractable K} \times -0.116)]$$

The K recommendations are for the total amount of broadcast and banded nutrients to be applied. If extractable K is greater than 130 ppm, then basic K recommendation is zero. If extractable K is less than 130 ppm, then the minimum K recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

### Potassium Sufficiency Recommendations

| Extractable K<br>Soil Test | Category  | Expected Yield (ton/a)           |     |     |     |     |
|----------------------------|-----------|----------------------------------|-----|-----|-----|-----|
|                            |           | 2                                | 2.5 | 3   | 3.5 | 4   |
| (ppm)                      |           | -----lb K <sub>2</sub> O/a ----- |     |     |     |     |
| 0 – 40                     | Very Low  | 100                              | 110 | 115 | 120 | 130 |
| 41 – 80                    | Low       | 65                               | 70  | 75  | 75  | 80  |
| 81 – 130                   | Medium    | 25                               | 25  | 25  | 25  | 30  |
| 131 – 160                  | High      | 0                                | 0   | 0   | 0   | 0   |
| 161+                       | Very High | 0                                | 0   | 0   | 0   | 0   |

# Potassium Recommendations

## Bermudagrass

$$\text{Bermuda Sufficiency K Rec} = [75 + (6.25 \times \text{Expected Yield}) + (\text{Extractable K} \times -0.5) + (\text{Expected Yield} \times \text{Extractable K} \times -0.042)]$$

The K recommendations are for the total amount of broadcast and banded nutrients to be applied. If extractable K is greater than 150 ppm, then basic K recommendation is zero. If extractable K is less than 150 ppm, then the minimum K recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

### Potassium Sufficiency Recommendations

| Extractable K<br>Soil Test | Category  | Expected Yield (ton/a)           |    |    |     |     |
|----------------------------|-----------|----------------------------------|----|----|-----|-----|
|                            |           | 2                                | 4  | 6  | 8   | 10  |
| (ppm)                      |           | -----lb K <sub>2</sub> O/a ----- |    |    |     |     |
| 0 – 50                     | Very Low  | 75                               | 85 | 95 | 105 | 115 |
| 51 – 100                   | Low       | 45                               | 50 | 55 | 60  | 70  |
| 101 – 150                  | Medium    | 15                               | 15 | 20 | 20  | 20  |
| 151 – 180                  | High      | 0                                | 0  | 0  | 0   | 0   |
| 181+                       | Very High | 0                                | 0  | 0  | 0   | 0   |

## New Bermudagrass

$$\text{Bermuda Sufficiency K Rec} = [105 + (15 \times \text{Expected Yield}) + (\text{Extractable K} \times -0.7) + (\text{Expected Yield} \times \text{Extractable K} \times -0.1)]$$

The K recommendations are for the total amount of broadcast and banded nutrients to be applied. If extractable K is greater than 150 ppm, then basic K recommendation is zero. If extractable K is less than 150 ppm, then the minimum K recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

### Potassium Sufficiency Recommendations

| Extractable K<br>Soil Test | Category  | Expected Yield (ton/a)           |     |     |     |     |
|----------------------------|-----------|----------------------------------|-----|-----|-----|-----|
|                            |           | 2                                | 3   | 4   | 5   | 6   |
| (ppm)                      |           | -----lb K <sub>2</sub> O/a ----- |     |     |     |     |
| 0 – 50                     | Very Low  | 115                              | 125 | 140 | 150 | 165 |
| 51 – 100                   | Low       | 65                               | 75  | 80  | 90  | 95  |
| 101 – 150                  | Medium    | 20                               | 25  | 25  | 30  | 30  |
| 151 – 180                  | High      | 0                                | 0   | 0   | 0   | 0   |
| 181+                       | Very High | 0                                | 0   | 0   | 0   | 0   |

# Potassium Recommendations

## Alfalfa and Clover

$$\text{Alfalfa/Clover Sufficiency K Rec} = [84 + (5.24 \times \text{Expected Yield}) + (\text{Extractable K} \times -0.56) + (\text{Expected Yield} \times \text{Extractable K} \times -0.035)]$$

The K recommendations are for the total amount of broadcast and banded nutrients to be applied. If extractable K is greater than 150 ppm, then basic K recommendation is zero. If extractable K is less than 150 ppm, then the minimum K recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

### Potassium Sufficiency Recommendations

| Extractable K<br>Soil Test | Category  | Expected Yield (ton/a)           |    |    |     |     |
|----------------------------|-----------|----------------------------------|----|----|-----|-----|
|                            |           | 2                                | 4  | 6  | 8   | 10  |
| (ppm)                      |           | -----lb K <sub>2</sub> O/a ----- |    |    |     |     |
| 0 – 50                     | Very Low  | 80                               | 85 | 95 | 105 | 115 |
| 51 – 100                   | Low       | 45                               | 50 | 55 | 65  | 70  |
| 101 – 150                  | Medium    | 15                               | 15 | 20 | 20  | 20  |
| 151 – 180                  | High      | 0                                | 0  | 0  | 0   | 0   |
| 181+                       | Very High | 0                                | 0  | 0  | 0   | 0   |

$$\text{Potassium Build-Maintenance Rec} = \left\{ \frac{(150 - \text{Current K Soil Test}) \times 9}{\text{Years To Build}} \right\} + \text{K}_2\text{O Removal In Crop}$$

The goal of the initial phase is to build the soil test value to the critical soil test value (CSTV) of 150 ppm, and subsequently maintain it within the range of 150 to 180 ppm through crop removal replacement. The quantity of K<sub>2</sub>O fertilizer required to elevate the soil test K value differs according to soil type, in addition to differences in K crop removal, cycling to the soil and soil-K interaction, therefore regular soil sampling is necessary to keep track of soil test levels.

Four-, six-, and eight-year time frames below are examples only. Build programs can be over longer time frames, however, build-maintenance recommendations should not be less than crop sufficiency-based fertility programs.

### Potassium Build-Maintenance Recommendations

| Extractable K<br>Soil Test | Category  | 4-Year Build Time Frame,<br>Expected Yield (ton/a) |     |     | 6-Year Build Time Frame,<br>Expected Yield (ton/a) |     |     | 8-Year Build Time Frame,<br>Expected Yield (ton/a) |     |     |
|----------------------------|-----------|--|-----|-----|--|-----|-----|--|-----|-----|
|                            |           | 2  | 6   | 10  | 2  | 6   | 10  | 2  | 6   | 10  |
| (ppm)                      |           | ----- lb K <sub>2</sub> O/a -----                  |     |     | ----- lb K <sub>2</sub> O/a -----                  |     |     | ----- lb K <sub>2</sub> O/a -----                  |     |     |
| 0 – 50                     | Very Low  | 356  | 596 | 836 | 278  | 518 | 758 | 238  | 478 | 718 |
| 51 – 100                   | Low       | 243  | 483 | 723 | 202  | 442 | 682 | 181  | 421 | 661 |
| 101 – 150                  | Medium    | 130  | 370 | 610 | 127  | 367 | 607 | 125  | 365 | 605 |
| 151 – 180 *                | High      | 120  | 360 | 600 | 120  | 360 | 600 | 120  | 360 | 600 |
| 181+                       | Very High | 0  | 0   | 0   | 0  | 0   | 0   | 0  | 0   | 0   |

\*Recommended amounts of K<sub>2</sub>O are based on crop nutrient removal only.

# Potassium Recommendations

## New Alfalfa and Clover

$$\text{New Alfalfa/Clover Sufficiency K Rec} = [105 + (15 \times \text{Expected Yield}) + (\text{Extractable K} \times -0.7) + (\text{Expected Yield} \times \text{Extractable K} \times -0.1)]$$

The K recommendations are for the total amount of broadcast and banded nutrients to be applied. If extractable K is greater than 150 ppm, then basic K recommendation is zero. If extractable K is less than 150 ppm, then the minimum K recommendation is 15 lb P<sub>2</sub>O<sub>5</sub>/a.

### Potassium Sufficiency Recommendations

| Extractable K<br>Soil Test | Category  | Expected Yield (ton/a)           |     |     |     |     |
|----------------------------|-----------|----------------------------------|-----|-----|-----|-----|
|                            |           | 2                                | 3   | 4   | 5   | 6   |
| (ppm)                      |           | -----lb K <sub>2</sub> O/a ----- |     |     |     |     |
| 0 – 50                     | Very Low  | 115                              | 125 | 140 | 150 | 165 |
| 51 – 100                   | Low       | 65                               | 75  | 80  | 90  | 95  |
| 101 – 150                  | Medium    | 20                               | 25  | 25  | 30  | 30  |
| 151 – 180                  | High      | 0                                | 0   | 0   | 0   | 0   |
| 181+                       | Very High | 0                                | 0   | 0   | 0   | 0   |

## Secondary and Micronutrients

### Chloride

Chloride fertilizer is recommended for wheat, corn and sorghum only.

#### Chloride Recommendation

| Profile Soil Chloride |         | Chloride Recommendation |
|-----------------------|---------|-------------------------|
| ppm                   | lb/a    | lb Cl/a                 |
| < 4                   | < 30    | 20                      |
| 4 – 6                 | 30 – 45 | 10                      |
| > 6                   | > 45    | 0                       |

### Boron

Do not band apply boron. Recommendations are for southeast Kansas in alfalfa, corn, sorghum and soybeans only. Test is not well calibrated.

#### Boron Recommendation

| DTPA Extractable B | Boron Recommendation |
|--------------------|----------------------|
| ppm                | lb B/a               |
| < 0.5              | 2                    |
| 0.6 – 1.0          | 1                    |
| > 1.0              | 0                    |

### Zinc

Zinc recommendation is for corn, sorghum and soybeans only.

Broadcast application is intended to build Zn soil test level to non-responsive range and correct soil deficiency for several years. If applied as banded starter at planting, application of about 0.5 – 1.0 lb Zn/a will correct crop deficiency for that crop year. Soil deficiency will likely remain.

Zinc recommendation for wheat, sunflowers, oats, alfalfa, brome, fescue, Bermudagrass and other crops. These crops show little to no response to zinc applications. No application is recommended.

#### Zinc Recommendation

$$\text{Zn Rate} = 11.5 - (11.25 \times \text{ppm DTPA Zn})$$

If DTPA Zn > 1.0 ppm then Zn Rec = 0

If DTPA Zn ≤ 1.0 ppm then Minimum Zn Rec = 1

# Secondary and Micronutrients

## Sulfur

**Corn and Grain Sorghum Sulfur Recommendation (lb/a) =  $(0.2 \times \text{Expected Yield}) - (2.5 \times \% \text{ OM}) - \text{Profile Sulfur} - \text{Other Sulfur Credits}$**

**Corn and Forage Sorghum Silage Sulfur Recommendation (lb/a) =  $(1.33 \times \text{Expected Yield}) - (2.5 \times \% \text{ OM}) - \text{Profile Sulfur} - \text{Other Sulfur Credits}$**

**Wheat Sulfur Recommendation (lb/a) =  $(0.6 \times \text{Expected Yield}) - (2.5 \times \% \text{ OM}) - \text{Profile Sulfur} - \text{Other Sulfur Credits}$**

**Soybean Sulfur Recommendation (lb/a) =  $(0.4 \times \text{Expected Yield}) - (2.5 \times \% \text{ OM}) - \text{Profile Sulfur} - \text{Other Sulfur Credits}$**

**Sunflower Sulfur Recommendation (lb/a) =  $(0.005 \times \text{Expected Yield}) - (2.5 \times \% \text{ OM}) - \text{Profile Sulfur} - \text{Other Sulfur Credits}$**

**Brome, Fescue & Bermudagrass Sulfur Recommendation (lb/a) =  $(5.0 \times \text{Expected Yield}) - (2.5 \times \% \text{ OM}) - \text{Profile Sulfur} - \text{Other Sulfur Credits}$**

**Alfalfa Sulfur Recommendation (lb/a) =  $(6.0 \times \text{Expected Yield}) - (2.5 \times \% \text{ OM}) - \text{Profile Sulfur} - \text{Other Sulfur Credits}$**

\*Default Profile Sulfur = 25 lb S/a

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