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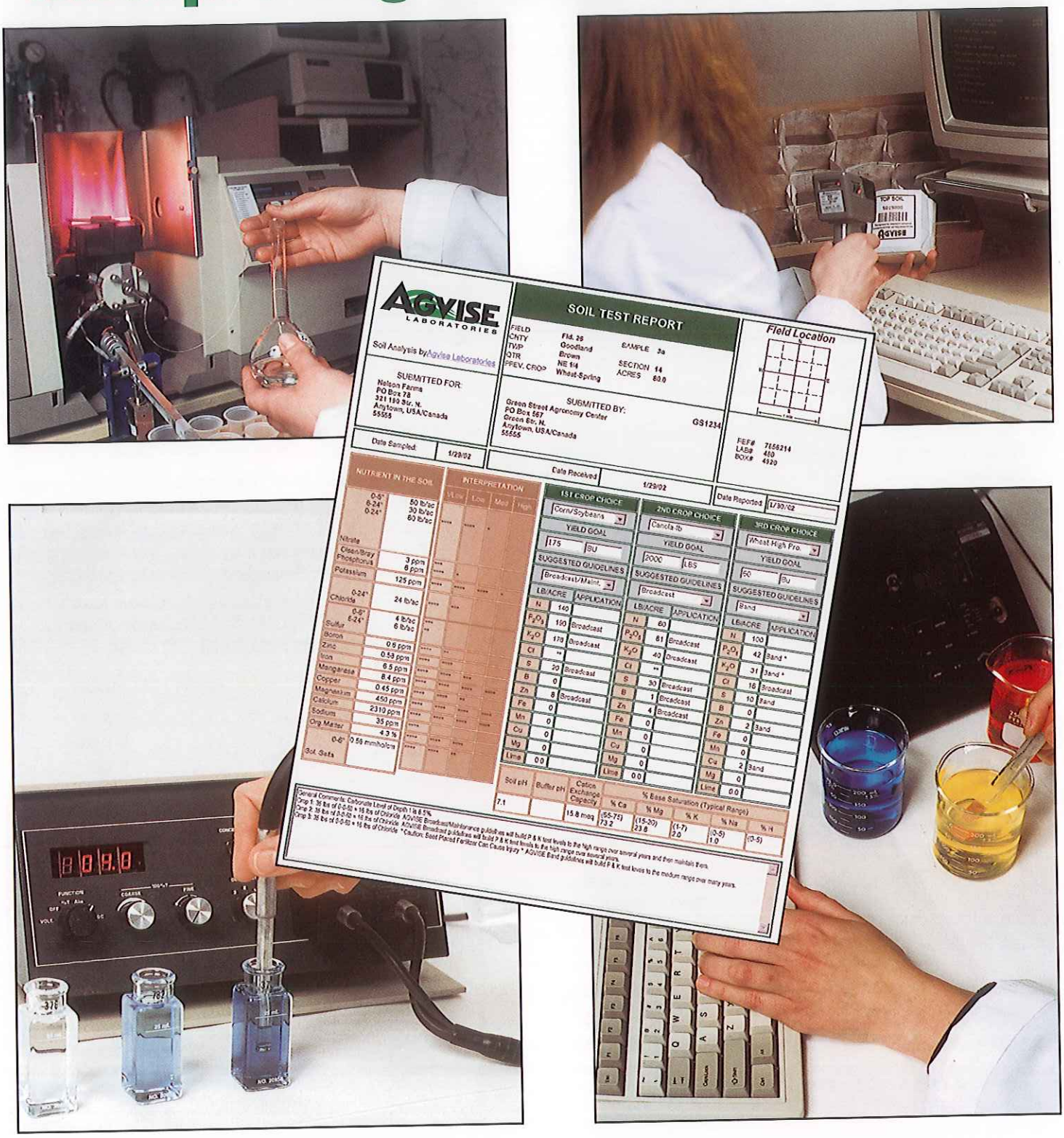
Interpreting A Soil Test Report



INTERPRETING AN AGVISE SOIL TEST REPORT

General Soil Sample Information

To gain the most information from soil testing, it is important to become familiar with the soil test report. This guide will explain where each soil test parameter is displayed on the report, along with information on the reporting units. There is also basic information about each test and how it pertains to soils in this region. Please remember to follow accepted guidelines for soil sampling to assure the data on the report represents the area being tested.

1 **Submitted for**: This is generally the name of the grower for whom the sample is submitted. This may also be the name of the farm manager, consultant etc. Some customers prefer to use a client number instead of a grower name.

2 **Submitted by**: The name of the firm or individual who has submitted the sample to the laboratory for analysis. This individual or firm is billed for the analysis conducted on the soil sample.

3 **Field**: Identifies where the sample was collected. The name of the field can be made up of any combination of letters and numbers (15 character limit).

4 **Sample**: Identifies each sample when there is more than one sample collected from each field (10 character limit).

5 **County**: Identifies the county the sample was taken in (15 character limit).

6 **Township**: Identifies the township the sample was taken in (15 character limit).

7 **Section**: Identifies the section of the township the sample was collected in (5 character limit).

8 **Quarter**: Identifies the quarter of the section the sample was collected in.

9 **Acres**: Identifies the acres represented by the soil sample submitted. (5 character limit).

10 **Previous crop**: Identifies the crop which was grown just prior to soil sampling. This information may be used to adjust nitrogen guidelines when a legume is the previous crop.

11 **Reference Number**: This is the number printed on the sample information sheet sent to the laboratory with the sample. Each sample has a distinct reference number and is tracked through the laboratory by this number. When calling the laboratory for information on a sample, the caller must know the reference number before information will be provided on any sample.

12 **Laboratory Number**: This number is assigned to each sample for internal use and quality control in the laboratory.

13 **Box Number**: This is the temporary storage box for this sample at the laboratory.

14 **Date Sampled**: Indicates the date the sample was collected.

15 **Date Received**: Indicates the date the sample arrived at the laboratory.

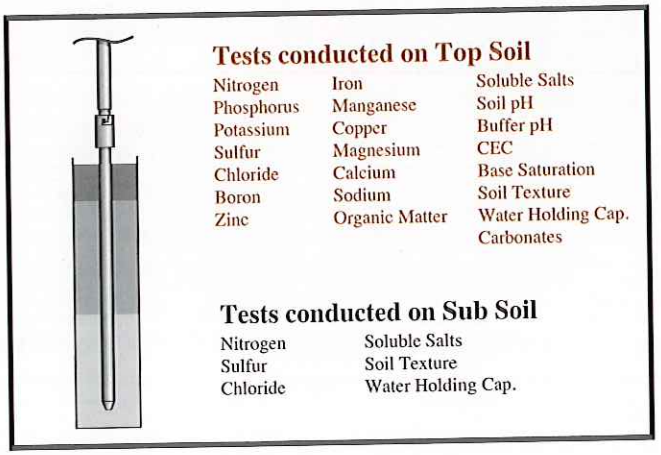
16 **Date Reported**: Indicates the date the soil sample report was printed.

LABORATORY ANALYSIS ON VARIOUS SOIL SAMPLE DEPTHS

The laboratory tests that are routinely run on each sample depth are shown in the figure below. The top-soil (0-6") is analyzed for all nutrients and physical soil properties. The sub-soil (6-24") is analyzed for mobile nutrients such as nitrate-nitrogen, sulfur, chloride and soluble salts. Deep sub-soil samples (24-48" or deeper) are also analyzed for nitrate-nitrogen.

A separate top-soil (0-6") sample is required for analysis of non-mobile nutrients such as phosphorus and potassium. If 0-12" or 0-24" samples are submitted for phosphorus and potassium analysis, the resulting laboratory data and fertilizer guidelines may not be correct. The subsoil contains little phosphorus in most areas. The example below indicates how sampling depth can affect phosphorus soil test levels.

Examples:		P soil test (ppm)
Sample Depth	0"-6"	15 ppm
Sample Depth	0"-12"	9 ppm
Sample Depth	0"-15"	6 ppm



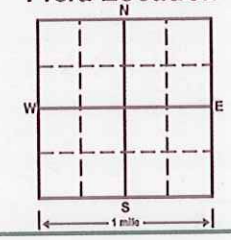
AGVISE LABORATORIES

Soil Analysis by Agvise Laboratories

SOIL TEST REPORT

FIELD	Fld. 26 (3)	SAMPLE	3a (4)
CNTY	(5) Goodland		
TWP	Brown (6)	SECTION	14 (7)
QTR	(8) NE 1/4	ACRES	80.0 (9)
PREV. CROP	Wheat-Spring (10)		

Field Location



(1) SUBMITTED FOR:
Nelson Farms
PO Box 78
321 190 Str. N.
Anytown, USA/Canada
55555

(2) SUBMITTED BY: GS1234
Green Street Agronomy Center
PO Box 567
Green Str. N.
Anytown, USA/Canada
55555

REF# 7856214 (11)
LAB# 480 (12)
BOX# 4920 (13)

Date Sampled: (14) 1/29/02 | Date Received: (15) 1/29/02 | Date Reported: 1/30/02 (16)

NUTRIENT IN THE SOIL		INTERPRETATION VLow	Low	Med	High
Nitrate (17)	0-6" 50 lb/ac 6-24" 30 lb/ac 0-24" 80 lb/ac	****	****	* (37)	
Olsen/Bray Phosphorus	(18) 3 ppm (19) 6 ppm	*** ****	*		
Potassium	(20) 125 ppm	****	****	****	*
Chloride	0-24" (21) 24 lb/ac	****	***		
Sulfur	0-6" 4 lb/ac 6-24" (22) 6 lb/ac	*** **			
Boron	(23) 0.6 ppm	****	**		
Zinc	(24) 0.58 ppm	****	****		
Iron	(25) 6.5 ppm	****	****	***	
Manganese	(26) 8.4 ppm	****	****	****	****
Copper	(27) 0.45 ppm	****	****	**	
Magnesium	(28) 450 ppm	****	****	****	****
Calcium	(29) 2310 ppm	****	****	****	****
Sodium	(30) 35 ppm	****			
Org.Matter	(31) 4.3 %	****	****	****	
Sol. Salts	0-6" 0.56 mmho/cm (32)	****	****	**	

1ST CROP CHOICE			2ND CROP CHOICE			3RD CROP CHOICE		
Corn/Soybeans			Canola-lb			Wheat-High Pro.		
YIELD GOAL			YIELD GOAL			YIELD GOAL		
175	BU		2000	LBS		60	Bu	
SUGGESTED GUIDELINES			SUGGESTED GUIDELINES			SUGGESTED GUIDELINES		
(39) Broadcast/Maint.			Broadcast			Band		
LB/ACRE		APPLICATION	LB/ACRE		APPLICATION	LB/ACRE		APPLICATION
N	140		N	60		N	100	
P_2O_5	190	Broadcast	P_2O_5	81	Broadcast	P_2O_5	42	Band *
K_2O	178	Broadcast	K_2O	40	Broadcast	K_2O	31	Band *
Cl	**		Cl	**		Cl	16	Broadcast
S	20	Broadcast	S	30	Broadcast	S	10	Band
B	0		B	1	Broadcast	B	0	
Zn	8	Broadcast	Zn	4	Broadcast	Zn	2	Band
Fe	0		Fe	0		Fe	0	
Mn	0		Mn	0		Mn	0	
Cu	0		Cu	0		Cu	2	Band
Mg	0		Mg	0		Mg	0	
Lime	0.0		Lime	0.0		Lime	0.0	

Soil pH	Buffer pH	Cation Exchange Capacity	% Base Saturation (Typical Range) (36)				
			% Ca	% Mg	% K	% Na	% H
7.1 (33)	(34)	15.8 m (35)	(65-75) 73.2	(15-20) 23.8	(1-7) 2.0	(0-5) 1.0	(0-5)

General Comments: Carbonate Level of Depth 1 is 6.5%. (38)
Crop 1: 35 lbs of 0-0-60 = 16 lbs of Chloride AGVISE Broadcast/Maintenance guidelines will build P & K test levels to the high range over several years and then maintain them.
Crop 2: 35 lbs of 0-0-60 = 16 lbs of Chloride AGVISE Broadcast guidelines will build P & K test levels to the high range over several years.
Crop 3: 35 lbs of 0-0-60 = 16 lbs of Chloride * Caution: Seed Placed Fertilizer Can Cause Injury * AGVISE Band guidelines will build P & K test levels to the medium range over many years.

SOIL TEST DATA

17 **Nitrate-Nitrogen (N)**: Nitrogen is reported in lbs/acre. Nitrate-nitrogen is mobile in the soil solution and should be tested to a minimum of 24 inches for most crops. For deep rooted nitrogen sensitive crops, such as sugar beets, nitrogen should be tested to 48 inches. Relative levels for nitrogen (0-24" samples) in the soil are: Very Low = 0-37 lbs/acre, Low = 38-74 lbs/acre, Medium = 75-111 lbs/acre, High > 111 lbs/acre. Sandy well drained soils often have low nitrate levels. If nitrogen levels in the top soil are low, additional nitrogen fertilizer may be necessary to supply nitrogen early in the season.

18 **Phosphorus (P) (Olsen-Bicarbonate phosphorus test can be used on both acid and basic soils):** The Olsen-Bicarbonate phosphorus test is reported in ppm. Phosphorus is not mobile in the soil and should be tested on the topsoil (0-6"). Relative levels for Olsen-Bicarbonate phosphorus test are: Very Low = 1-3 ppm, Low = 4-7 ppm, Medium = 8-11 ppm, High = 12-15 ppm, Very High > 15 ppm.

19 **Phosphorus (P) (Bray 1 phosphorus test should be used on soils with pH less than 7.0)** The Bray 1 phosphorus test is reported in ppm. Phosphorus is not mobile in the soil and should be tested on the topsoil (0-6"). Relative levels for Bray 1 phosphorus test are: Very Low = 1-5 ppm, Low = 6-10 ppm, Medium = 11-15 ppm, High = 16-20 ppm, Very High >20 ppm.

20 **Potassium (K) (Ammonium Acetate Exchangeable K test)**: Potassium is reported in ppm. Potassium is not generally mobile in the soil and should be tested on the topsoil (0-6"). Relative levels for potassium are: Very Low = 1-40 ppm, Low = 41-80 ppm, Medium = 81-120 ppm, High = 121-160 ppm, Very High >160 ppm. Sandy soil types are often low in potassium.

21 **Chloride (Cl):** Chloride is reported in lbs/acre. Chloride is mobile in the soil solution and should be tested to a depth of 24". Relative levels for chloride are: Very Low = 1-15 lbs/acre, Low = 16-30 lbs/acre, Medium = 31-45 lbs/acre, High = 46-60 lbs/acre, Very High > 60 lbs/acre for 0-24" samples. Soils that never had potassium chloride (potash) fertilizer applied and are nonsaline are often low in chloride. Small grains (wheat, barley, rye) are most sensitive to low soil chloride levels.

22 **Sulfur (S-sulfate):** Sulfur is reported in lbs/acre. Sulfur is mobile in the soil solution and should be tested to a depth of 24 inches. Relative sulfur levels are: Very Low = < 1-25 lbs/acre, Low = 26-59 lbs/acre, Medium = 60-120 lbs/acre, High >120 lbs/acre for 0-24" samples. Sandy well drained soils are often low in sulfur. Shallow rooted crops or crops with high sulfur requirements (i.e. canola) may require higher rates of sulfur fertilizer.

23 **Boron (B):** Boron is reported in ppm. Boron is mobile in the soil solution. Boron should be tested on the topsoil (0-6"). Relative levels for boron are: Very Low = .1-.4 ppm, Low = .5-.8 ppm, Medium = .9-1.2 ppm, High = 1.3- 1.6 ppm, Very High > 1.6 ppm. Sandy well drained soils are often low in boron. Crops most sensitive to boron include alfalfa and clover.

24 **Zinc (Zn):** Zinc is reported in ppm. Zinc is not mobile in the soil solution and should be tested on the topsoil (0-6"). Relative levels for zinc are: Very Low = .1-.3 ppm, Low = .4-.6 ppm, Medium = .7-1.0 ppm, High = 1.0-2.0 ppm, Very High >2.0 ppm. Soils with high pH often test low in zinc. Crops most sensitive to zinc include corn, flax, potatoes and edible beans.

25 **Iron (Fe):** Iron is reported in ppm. Iron is not mobile in the soil and should be tested on the topsoil (0-6"). Relative levels for iron are: Very Low = .1-2.5 ppm, Low = 2.6-5.0 ppm, Medium = 5.1-7.5 ppm, High = 7.6-10.0 ppm, Very High >10.0 ppm. Crops most sensitive to iron include flax and most beans. Iron chlorosis often occurs on soils high in carbonates, high in soluble salts, or poorly drained soils regardless of soil iron levels.

26 **Manganese (Mn):** Manganese is reported in ppm. Manganese is not mobile in the soil and should be tested on the topsoil (0-6"). Relative levels for manganese are: Very Low = .1-1.0 ppm, Low = 1.1-2.0 ppm, Medium = 2.1-3.0 ppm, High = 3.1-4.0 ppm, Very High >4.0 ppm. Soils with high pH and high organic matter are often low in manganese.

27 **Copper (Cu):** Copper is reported in ppm. Copper is not mobile in the soil and should be tested on the topsoil (0-6"). Relative levels for copper are: Very Low = .1-.2 ppm, Low = .3-.4 ppm, Medium = .5-.6 ppm, High .7-.8 ppm, Very High >.8 ppm. Deep sandy soils with low organic matter or peat and muck soils often are low in copper. Crops sensitive to copper are winter wheat, spring wheat, barley, oats and rye.

28 **Magnesium (Mg):** Magnesium is reported in ppm. Magnesium is not mobile in the soil and should be tested on the topsoil (0-6"). Relative levels for Magnesium are: Low = 0-50 ppm, Medium = 51-100 ppm, High >100 ppm. On very acid (pH 5.5 or less) sandy soils, magnesium deficiency may occur on alfalfa, corn, potatoes or onions.

29 **Calcium (Ca):** Calcium is reported in ppm. Calcium is not mobile in the soil and should be tested on the topsoil (0-6"). Relative levels are: Very Low = 1-250 ppm, Low = 251-500 ppm, Medium = 501-2,000 ppm, High = 2,001-4,500 ppm, Very High >4,500 ppm. Sandy soils with a pH < 6.0 may be calcium deficient.

30 **Sodium (Na):** Sodium is reported in ppm. Sodium is not a plant nutrient but is tested because it can destroy soil structure and productivity at high levels. Sodium is not mobile in the soil solution and is generally tested on the topsoil (0-6"). Relative levels for sodium are: Very Low = 1-40 ppm, Low = 41-80 ppm, Medium = 81-120 ppm, High = 121-160 ppm, Very High >160 ppm. High levels of sodium reduce plant growth. High levels of sodium are often associated with high pH, irrigated soils and saline soils.

31 **Organic Matter (OM):** Organic matter is reported as percent. Organic matter levels in soil profiles are highest in the topsoil. Percent organic matter is determined on the topsoil (0-6"). Relative levels for organic matter are: Very Low = .1%-1.5%, Low = 1.6%-3.0%, Medium = 3.1%-4.5%, High = 4.6% - 6.0%, Very High >6.0%, Peat >15%. Sandy, well drained soils and eroded soils are often low in organic matter. The rate of soil applied herbicides may be based on the organic matter level of the soil.

32 **Soluble Salts (Electrical Conductivity):** Soluble salts are measured by the soils ability to conduct electricity and is reported in millimhos/cm. The more electricity a sample conducts the higher the soluble salts in the soil. Soluble salts are mobile in the soil solution and will move up and down with the water table. Soluble salts are commonly tested to a depth of 24" or deeper. Relative levels of soluble salts are: Very Low = .01-.25 mmhos/cm, Low = .26-.50 mmhos/cm, Medium = .51-.75 mmhos/cm, High = .76-2.0 mmhos/cm, Very High >2.0 mmhos/cm for each depth. High soluble salt levels severely affect plant growth. Crops vary widely in their sensitivity to soluble salts. High soluble salts are a major factor in soybean iron cholorosis.

33 **Soil pH (pH):** Soil pH is a measure of the hydrogen ion concentration of a soil. Soil pH is expressed on a logarithmic scale from 1.0-10.0. Soils with a pH <7.0 are termed acidic. Soils with a pH >7.0 are termed basic or alkaline. Crops vary widely in their sensitivity to soil pH. Soils with a pH less than 6.5 may have lime applied to raise the soil pH. Crop sensitivity to soil pH varies widely and affects how much, if any lime needs to be applied. Soil pH also affects the availability of many nutrients.

34 **Buffer pH:** Buffer pH is a test specifically designed to determine the amount of lime required to raise the pH of very acid soils. The Buffer pH test is reported on a logarithmic scale from 1.0-10.0. The buffer pH test is generally used on soils with a soil pH less than 6.0.

35 **Cation Exchange Capacity by summation(CEC):** The CEC of soil is reported in milliequivalents/100 grams of soil. The CEC is determined on the topsoil (0-6"). The CEC of a soil is an index of a soils ability to hold all cations (Ca++, Mg++ ,Na+, K+, H+). The CEC of a soil is closely related to soil texture. A CEC of 1-8 = Sand, 9-12 = Loamy Sand, 13-20 = Sandy or Silty Loam, 21-28 = Loam, 29-40 = Clay Loam and >40 = Clay or Peat. The CEC of soils with a pH less than 7.0 are accurately reflected by this test. Soils with pH >7.3 can contain excessive carbonates which will inflate CEC values. The CEC of a soil may be used to adjust rates of soil applied herbicides.

36 **Base Saturation:** The base saturation of a soil is expressed on a percent basis. The percent base saturation for each cation is calculated from the total amount of calcium, magnesium, potassium, sodium and hydrogen measured in the topsoil. Each nutrient is expressed as a percentage of the total amount of cations measured in the sample (i.e. a soil may have 70% Calcium + 20% Magnesium + 7% Potassium + 3% Sodium = 100%). Typical ranges for base saturation are: Calcium 65-75%, Magnesium 15-20%, Potassium 1-7%, Sodium 0-5%, Hydrogen 0-5%.

37 **Relative Test Level:** Indicates the relative level of each test. The bar graph display is designed to make explaining the relative level of each test easier.

38 **Carbonates:** (also known as calcium carbonate equivalent (CCE) or percent free lime): This is a measure of the total calcium and magnesium carbonate present in the soil as precipitated solid or crystal. A high level of carbonate is one factor that has been shown to increase the iron chlorosis in soybeans. Soils with a high level of carbonate and soluble salts may express severe iron chlorosis in soybeans. Soils with a high level of carbonate may also require higher levels of phosphorus fertilizer application due to phosphorus combining with calcium to form calcium phosphates with a low solubility. Relative level of carbonate: Low = 0-2.5%, Moderate = 2.5-5.0%, High = 5.0-10%, Very High > 10.0%. Soils with a pH 7.3 or lower have little or no carbonate, but soils with pH 7.4 or higher may have low or high levels of carbonate. There is no way to tell the carbonate level of a soil with a pH higher than 7.4 without a soil test.

SUGGESTED FERTILIZER GUIDELINES

39 AGVISE Laboratories offers three types of guidelines for phosphorus and potassium fertilization (Band, Broadcast and University). All fertilizer guidelines are reported in lbs/acre of P_2O_5 or K_2O. All fertilizer guidelines are based on research by universities and industry along with the experience of AGVISE's professional agronomic staff. A brief explanation of each of the three fertilizer guidelines is listed below:

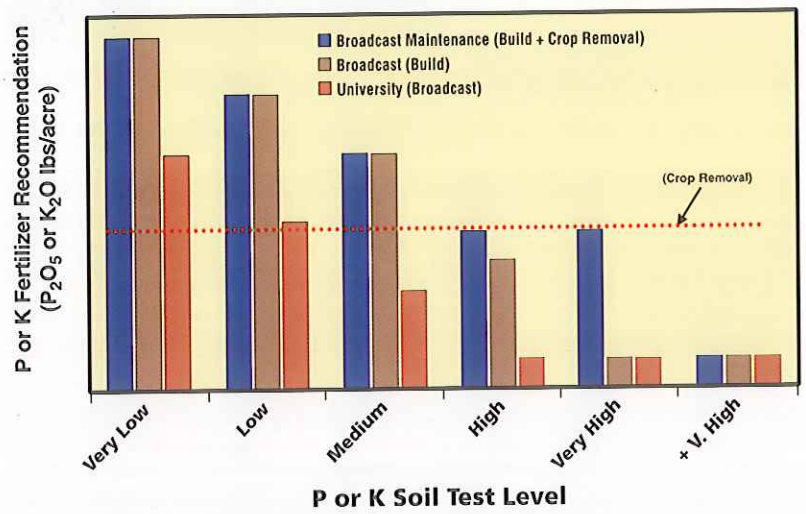
Band P & K fertilizer guideline: The AGVISE band fertilizer guideline assumes that the P & K fertilizer is placed at least 2" away from the seed. If an excessive amount of fertilizer is placed directly with the seed, delayed emergence and stand loss may occur. The safe rate of fertilizer to place with the seed is determined by soil moisture status, row width, fertilizer material and crop sensitivity. Use local information from consultants and equipment manufacturers to determine safe rates of seed applied fertilizer.

At very low soil test levels the band fertilizer guidelines for P & K will slowly build the P or K soil test level to the medium level over a period of many years. When the P or K soil test is high, the band guideline is reduced to near zero with a small amount of starter P & K fertilizer suggested. If soil test levels are high initially and the band guideline is followed for many years, the soil test level will drop to the medium test range.

Band with Maintenance P & K fertilizer guideline: The AGVISE band with maintenance fertilizer guideline is the same as the band fertilizer guideline except when P & K soil test levels are medium or higher, the band with maintenance guideline is equal to crop removal levels of P & K.

University Broadcast fertilizer guideline: The University broadcast fertilizer guidelines are based on one set of guidelines provided by the University of Minnesota, North Dakota State University and South Dakota State University. At very low soil test levels the university broadcast guidelines for P & K will slowly build the test levels to the medium range over many years. When the P or K soil test levels are high, the university broadcast guideline is reduced to near zero. Even when the university broadcast guidelines are zero, university agronomists would recommend using a small amount of starter fertilizer for most crops. The graph below shows the relationship between the band guideline, the band with maintenance and the university guidelines.

Comparison of Broadcast Guidelines



Broadcast P & K fertilizer guideline: The AGVISE broadcast fertilizer guidelines are based on a uniform fertilizer application which is then tilled into the topsoil (except in the case of alfalfa). Seed safety is generally not a concern with broadcast fertilizer applications.

At very low, low and medium soil test levels, the broadcast fertilizer guidelines will build the P or K soil test levels to the high range if followed over several years. When the soil test level for P & K are into the very high range, the broadcast guidelines are reduced to near zero and a small amount of starter P & K is suggested.

Broadcast with Maintenance P & K fertilizer guideline: The AGVISE broadcast with maintenance guidelines are the same as the broadcast fertilizer guidelines except at the high and very high P & K soil test levels. When the P & K soil test levels are at high and very high, the broadcast with maintenance guidelines are equal to crop removal. The figure above shows the relationship between the broadcast, broadcast with maintenance, university guidelines and crop removal.

Comparison of Band Guidelines