

ECOPHIRST™

GYPSUM PELLETS

- EASY TO USE - FREE FLOWING
- LOOSENS COMPACTED SOILS
- INCREASES WATER INFILTRATION RATE
- ENCOURAGES DEEPER ROOT STRUCTURE
- SUPPLIES ESSENTIAL CALCIUM & SULFUR
- APPLY ANYTIME
- USE BROADCAST OR DROP SPREADER
- NON-TOXIC
- DISSOLVES QUICKLY



100% Natural Product

SUGGESTED SPREADER SETTINGS

SPREADER	LBS./1000 SQ. FT.		
	10	20	40
Cyclone(Broadcast)	5	6-7 1/2	2x20 rate
Earthway EV-N-SPRED	1-1 1/2	20	Full open #34
Franks(Broadcast)	3	7 1/2	16 1/2
Franks(Drop)	9	10 1/4	11 3/4
PrizeLawn(Broadcast)	5 1/4-5 1/2	7-8 1/2	2x20 rate
Scotts SG1(Broadcast)	6	8-8 1/2	15-16
Scotts PF3/PF4(Drop)	6 1/4-7	9-11	16
Red Devil (Drop)	3 1/2	7 1/4	10 1/2
Republic (Drop)	9 1/2	11	12 1/2
Sears(Broadcast)	3 1/4	4 1/2	6 1/2
Sears(Drop)	5 1/2	7	10
Spyker(Broadcast)	4 1/4	5 1/2	8 7/8

NOTE: Rates may vary from suggested settings.

MINIMUM GUARANTEED ANALYSIS

(Binder & Moisture Free Basis)

Calcium (Ca)	22.0%
Sulfur (S)	19.0%
Calcium Sulfate (CaSo4)	79.0%
Water Soluble Binder	2.0%
Moisture (Maximum)	1.0%

PARTICLE SIZE BEFORE PELLETIZING

MINIMUM PASSING	SCREEN SIZE*
100%	8 mesh
99%	10 mesh
99%	20 mesh
79%	40 mesh
70%	50 mesh
66%	60 mesh
60%	100 mesh

*U.S. Standard Sieve

DIRECTIONS FOR USE

NEW LAWNS: Apply 80 lbs. per 1000 square feet before seeding. Mix thoroughly into the surface soil. Use higher rates for clay soils.

ESTABLISHED LAWNS: Apply 40 lbs. per 1000 square feet two times a year. Spring and Fall. Water thoroughly after application.

GARDENS: Apply 20 lbs. per 100 square feet before planting. Mix thoroughly into the top 4-6 inches of soil.

FLOWER BEDS: Apply 20-30 lbs. per 100 square feet before planting. Mix thoroughly into the soil.

ROSES: Apply 1/2-1 lb. around plant base two times a year. Spring and Fall. Mix into soil with spade. Water thoroughly.

TREES & SHRUBS: Apply 1 lb. around base of shrubs and 2-3 lbs. around base of evergreens and ornamental trees. Mix into soil with spade. Water thoroughly.

WINTER SALT DAMAGE, ANIMAL SPOTS: Apply 20 lbs. per 100 square feet for large areas and 1/4-1/2 lb. per square foot for small areas. Water thoroughly.

COMPOSTING: Evenly distribute 1 lb. over each bushel of material as it is added to the compost pile or composter. Turn compost daily and add 1 more lb. per day until complete. (Approximately 1-2 weeks)

For Optimum Soil Incorporation: After application, wet thoroughly 30 minutes before blending into soil.

ECOPHRST™

DOLOMITIC Limestone Pellets (Regular) 100% Natural Product

- NEUTRALIZES ACID SOILS
- INCREASES NUTRIENT AVAILABILITY
- CONTAINS ESSENTIAL CALCIUM & MAGNESIUM
- IMPROVES SOIL STRUCTURE
- INCREASES MICRO-ORGANISM ACTIVITY
- EASY TO USE - FREE FLOWING
- APPLY WITH BROADCAST OR DROP SPREADER
- APPLY ANYTIME
- CAN BE APPLIED WITH DRY FERTILIZERS



The acidity or basicity of a soil is expressed by the term pH. A pH value of 7.0 is neutral, values below 7.0 are acid, and values above 7.0 are basic. **SOIL pH IS CRITICAL IN THAT IT SIGNIFICANTLY AFFECTS THE AVAILABILITY OF MOST OF THE CHEMICAL ELEMENTS NEEDED BY PLANTS AND MICRO-ORGANISMS.**

ECOPHRST DOLOMITIC LIMESTONE PELLETS neutralize acid soils. The pellets are made from finely ground limestone and a water soluble binder. The finely ground limestone results in fast chemical reactions in the soil thus quickly neutralizing acid conditions. The binder holds the finely ground limestone in a pellet form that offers convenience and ease of handling.

ECOPHRST PELLETS can be easily applied with any type of spreader, alone or blended with fertilizers. Once applied, the pellets dissolve with soil moisture or rainfall back into the finely ground limestone for fast chemical reaction.

THE MOST ACCURATE MEANS TO DETERMINE QUANTITY OF LIMESTONE NEEDED IS TO HAVE YOUR SOIL TESTED.

If a soil test is not available, the following table may be used as a guide only:

SOIL TEXTURE			
	SAND	LOAM	CLAY
SOIL pH 6.0	25	35	50
5.5	60	70	90
5.0	80	115	160

LBS. OF LIMESTONE NEEDED PER 1000 SQ. FT. TO RAISE SOIL pH to 6.5

Contact your local fertilizer supplier or University Extension Service for additional assistance.

TO DETERMINE RATES PER ACRE: multiply lbs. per 1000 sq. ft. by 43.5.

DIRECTIONS FOR USE

TURF

NEW TURF: apply 40 lbs. per 1000 square feet before seeding. Mix thoroughly into the top 2-4 inches of soil. **ESTABLISHED TURF:** Apply 10 lbs. per 1000 square feet. **CLAY SOILS:** apply 14 lbs. per 1000 square feet.

MAINTENANCE APPLICATION: apply 2 lbs. for each 1 lb. of actual nitrogen applied.

FOR OPTIMUM SOIL APPLICATION: after application wet thoroughly 30 minutes before tilling.

AGRONOMIC CROPS

GRAINS, FORAGES, OIL CROPS, FIBER CROPS: refer to your University recommendations for optimum soil pH for optimum yields. Apply rates of ECOPHRST pellets accordingly. Pellets may be applied alone or blended with dry fertilizers, applied to the soil surface or incorporated, applied in the row or broadcast.

HORTICULTURAL CROPS

VEGETABLES, FRUITS, NURSERIES, FLOWERS: refer to your University recommendations for optimum soil pH for optimum yields. Apply rates of ECOPHRST pellets accordingly. Pellets may be applied alone or blended with dry fertilizers, applied to the soil surface or incorporated, applied in the row or broadcast.

SPECIALTY AND OTHER CROPS

Refer to your University recommendations for optimum soil pH for optimum yields. Apply rates of ECOPHRST pellets accordingly. Pellets may be applied alone or blended with dry fertilizers, applied to the soil surface or incorporated, applied in the row or broadcast.

MINIMUM GUARANTEED ANALYSIS (Binder & Moisture Free Basis)

Elemental Calcium (Ca)	21.0%
Elemental Magnesium (Mg)	12.0%
Calcium Carbonate Equivalent	105.0%
Carbonates	
Calcium Carbonate (CaCO ₃)	52.4%
Magnesium Carbonate (MgCO ₃)	41.6%
Total Carbonates	97.5%
Oxides	
Calcium Oxide (CaO)	29.4%
Magnesium Oxide (MgO)	19.9%
Total Oxides	51.1%
Water Soluble Binder (Minimum)	Approx. 2.0%
Moisture (Maximum)	1.0%

FLORIDA This product requires 1714 pounds to be equal to one ton of standard lining material. Neutralizing value is 105.0% Calcium Carbonate Equivalence.

KANSAS ECC = 99.7%

MINNESOTA 1920 lbs. ENP per ton.

MISSOURI ENM = 803

NEBRASKA ECCE = 98.7%
1974 lbs. of ECCE per ton.

NEW YORK ENV = 95.0%

N. CAROLINA 1904 lbs. of this material equals one ton of standard lining material.

OHIO TNP = 105.0%

OKLAHOMA ECCE = 99.7%

PENNSYLVANIA ENV = 102.0% Meets fine-sized fineness classification, prior to pelletizing.

TENNESSEE RNV = 104.0%

WISCONSIN Neutralizing Index = 100.8%
Neutralizing Index Zone = 100 or more

GIANT PUMPKIN PARTICLE SIZE BEFORE PELLETIZING

MINIMUM PASSING	SCREEN SIZE*
100	4 mesh
100	8 mesh
100	10 mesh
100	20 mesh
99	40 mesh
99	50 mesh
98	60 mesh
93	100 mesh
65	200 mesh

*U.S. Standard Sieve

Manufactured by:
NATIONAL LIME AND STONE CO.
P.O. BOX 120
FINDLAY, OH 45839-0120
419.427.4241



CALCIUM Limestone Pellets

- EASY TO USE - FREE FLOWING
- CONTAINS ESSENTIAL CALCIUM & MAGNESIUM
- IMPROVES SOIL STRUCTURE
- INCREASES MICRO-ORGANISM ACTIVITY
- APPLY WITH BROADCAST OR DROP SPREADER
- APPLY ANYTIME
- CAN BE APPLIED WITH DRY FERTILIZERS
- INCREASES NUTRIENT AVAILABILITY
- IMPROVES GARDEN YIELDS



100% Natural Product

MINIMUM GUARANTEED ANALYSIS (Binder & Moisture Free Basis)

Elemental Calcium (Ca)	30.0%
Elemental Magnesium (Mg)	4.0%
Calcium Carbonate Equivalent	97.0%
Carbonates	
Calcium Carbonate (CaCO ₃)	74.9%
Magnesium Carbonate (MgCO ₃)	13.9%
Total Carbonates	93.7%
Oxides	
Calcium Oxide (CaO)	42.0%
Magnesium Oxide (MgO)	6.6%
Total Oxides	51.5%
Water Soluble Binder (Minimum)	Approx. 2.0%
Moisture (Maximum)	1.0%

DIRECTIONS FOR USE*

NEW LAWNS: Before seeding apply 40 lbs. per 1000 square feet. Best when blended into the soil.

ESTABLISHED LAWNS: Apply 10 lbs. per 1000 square feet. For clay soils, apply 15 lbs. per 1000 square feet.

GARDENS: Apply 60-80 lbs. per 1000 square feet. Mix thoroughly into the top 4 - 6 inches of soil.

For Optimum Soil Incorporation: After application, wet thoroughly 30 minutes before blending into soil.

SUGGESTED SPREADER SETTINGS

SPREADER	LBS./1000 SQ. FT.		
	10	20	40
Cyclone(Broadcast)	5	6-7 1/2	2x20 rate
Earthway EV-N-SPRED	14 1/2	20	Full open #34
Franks(Broadcast)	3	7 1/2	16 1/2
Franks(Drop)	9	10 1/4	11 3/4
PrizeLawn(Broadcast)	5 1/4-5 1/2	7-8 1/2	2x20 rate
Scotts SG1(Broadcast)	6	8-8 1/2	15-16
Scotts PF3,PF4(Drop)	6 1/4-7	9-11	16
Red Devil (Drop)	3 1/2	7 1/4	10 1/2
Republic (Drop)	9 1/2	11	12 1/2
Sears(Broadcast)	3 1/4	4 1/2	6 1/2
Sears(Drop)	5 1/2	7	10
Spyker(Broadcast)	4 1/4	5 1/2	8 7/8

NOTE: Rates may vary from suggested settings.

* For best results, test soil first to determine soil pH and amount of limestone needed. Optimum pH for most plants is approximately 6.5.

FLORIDA	This product requires 1856 pounds to be equal to one ton of standard liming material. Neutralizing value is 97.0% Calcium Carbonate Equivalence.
KANSAS	ECC = 92.1%
MINNESOTA	1769 lbs. ENP per ton.
MISSOURI	ENM = 745
NEBRASKA	ECCE = 91.2% 1824 lbs. of ECCE per ton.
NEW YORK	ENV = 87.0%
N. CAROLINA	2062 lbs. of this material equals one ton of standard liming materials.
OHIO	TNP = 97.0%
OKLAHOMA	ECCE = 92.1%
PENNSYLVANIA	E.N.P. = 88.3%
TENNESSEE	RNV = 96.3%
WISCONSIN	Neutralizing Index = 93.1% Neutralizing Index Zone = 90-99

PARTICLE SIZE BEFORE PELLETIZING

MINIMUM PASSING	SCREEN SIZE*
100	4 mesh
100	8 mesh
100	10 mesh
100	20 mesh
99	40 mesh
99	50 mesh
96	60 mesh
91	100 mesh

*U.S. Standard Sieve

Manufactured by: NATIONAL LIME AND STONE CO. / P.O. BOX 120 / FINDLAY, OH 45839-0120 / 419-422-4341

TOTAL P. 01

LIMING MATERIAL CONVERSION TABLE

The limestone recommendation on your soil test report is based on the use of a liming material equivalent in neutralizing power to 100% calcium carbonate limestone. The recommendations are in pounds of calcium carbonate equivalent (CCE) per acre. The use of any liming material that is not equivalent in neutralizing power to pure calcium carbonate limestone (100% CCE) must be adjusted so that you actually apply enough liming material to neutralize the acidity in your soil. All agricultural liming materials sold in Pennsylvania are required by law to be labeled with their calcium carbonate equivalent (CCE). Using the CCE of your liming material, the amount required to supply the recommended amount of neutralizing power (CCE) for your soil may be calculated as shown below or read directly from the table.

It is also very important that a liming material be ground fine enough to be effective. Pennsylvania aglime regulations classify agricultural liming materials into the following three groups based on fineness:

- | | |
|--|--|
| 1. Fine-sized
95% through a 20-mesh screen
60% through a 60-mesh screen
50% through a 100-mesh screen | 2. Medium-sized
90% through a 20-mesh screen
50% through a 60-mesh screen
30% through a 100-mesh screen |
|--|--|

3. Coarse-sized
All liming materials that fail to meet one of the above minimums for fineness.

A material meeting the standard for a fine-sized liming material is considered adequate for meeting soil test recommendations in most situations. It is assumed that fine-sized liming materials will react rapidly enough to effect a change in soil pH in the year of application and will typically remain effective for about three years. The medium- and coarse-sized materials will be slower to react and thus less effective in changing soil pH in the year of application and will take longer to completely react. The actual fineness must be printed on the liming material label.

Directions for using the conversion table:

Find your test limestone recommendation in the left hand column and then read across the table on that line until you come to the column headed by the % CCE nearest to that of your liming material. The number at that point is the pounds of liming material required to meet the limestone recommendation on your soil test.

Because there is generally little advantage to applying more than 8,000 pounds of CCE per acre in any one application to agricultural land, this table is divided into three sections suggesting how the total liming material required can be split for most efficient use. Separate the applications by 6 months time or at least by tillage operations. (See the right hand column).

Calculation of Actual Lime Requirement:

$$\text{Actual Liming Material Required} = \frac{\text{Soil Test Limestone Recommendation}}{\text{CCE of liming material to be used}} \times 100$$

Example:

Soil Test Recommendation:

Limestone – Apply 4,000 lbs. of calcium carbonate equivalent per acre.

Liming Material Label:

Calcium Carbonate Equivalent (CCE) = 80%

Actual Liming Material Required:

$$\frac{4000}{80} \times 100 = 5,000 \text{ lbs. liming material per acre.}$$

80

The calculations and table for adjusting your recommendations for the CCE of your liming material assume that the material meets the minimum fineness standards for fine-sized limestone. In selecting a liming material, there is generally little advantage in using material much finer than the minimum standards for fine-sized material. In emergency situations where a very rapid change in soil pH is required, paying extra for a finer material may be warranted. However, planning ahead by using a less expensive material and allowing it time to react will generally give better and more economical results.

Pounds per acre of Calcium Carbonate Equivalent Recommendation on your soil test	Percent Calcium Carbonate Equivalent (%CCE) of Your Liming Material								Divide Total into the Following Number Applications
	70	75	80	85	90	95	100	105	
1000	1400	1300	1200	1200	1100	1100	1000	1000	1
2000	2900	2700	2500	2400	2200	2100	2000	1900	
3000	4300	4000	3700	3500	3300	3200	3000	2900	
4000	5700	5300	5000	4700	4400	4200	4000	3800	
5000	7100	6700	6200	5900	5600	5300	5000	4800	
6000	8600	8000	7500	7100	6700	6300	6000	5700	
7000	10000	9300	8700	8200	7800	7400	7000	6700	
8000	11400	10700	10000	9400	8900	8400	8000	7600	
9000	12900	12000	11200	10600	10000	9500	9000	8600	2
10000	14300	13300	12500	11800	11100	10500	10000	9500	
11000	15700	14700	13700	12900	12200	11600	11000	10500	
12000	17100	16000	15000	14100	13300	12600	12000	11400	
13000	18600	17300	16200	15300	14400	13200	13000	12400	
14000	20000	18700	17500	16500	15600	14700	14000	13300	
15000	21400	20000	18700	17600	16700	15800	15000	14300	
16000	22900	21300	20000	18800	17800	16800	16000	15200	
17000	24300	22700	21200	20000	18900	17900	17000	16200	3
18000	25700	24000	22500	21200	20000	18900	18000	17100	
19000	27100	25300	23700	22400	21100	20000	19000	18100	
20000	28600	26700	25000	23500	22200	21100	20000	19000	

To convert to 1000 sq. ft. rate, divide the recommended value in the table by 43.5.

Prepared By: Douglas Beegle, Extension Agronomist.

MAGNESIUM CONVERSION TABLE

If the magnesium level was found to be too low or out of balance with the other nutrients an application of magnesium is recommended. There are a number of materials that can be used. If both limestone and magnesium are required it will be most economical, generally, to use a limestone containing magnesium. The amount of the various materials needed to supply the magnesium recommendation can be determined from the following table.

Row application of special fertilizer containing 2 to 4 percent magnesium may be used if soil levels of magnesium are low. This may reduce magnesium problems for the current year. However, this will not correct low magnesium levels in the soil as too little is applied. For example, an application of 500 lbs. of fertilizer containing 2% Mg will supply only 10 lbs. of magnesium. To benefit from an application of such small amounts, it must be applied in the row.

Annual application of magnesium material should not be necessary for most crops if soil test recommendations are followed.

APPROXIMATE POUNDS OF MATERIALS (nearest 5 lbs.) REQUIRED

For Magnesium recommendation of	Emjco (17% Mg)	Epson Salt (11% Mg)	K-Mag (11% Mg)	(10% MgO) (6% Mg)	Limestone (15% MgO) (9% Mg)	(20% MgO) (12% Mg)	Magox (50% Mg)	Magnesium Sulfate (10% Mg)	Sul-Po-Mag (11% Mg)
40 lbs. of Mg. use	230	360	360	650	450	350	80	360	360
50 lbs of Mg. use	295	450	450	850	550	400	100	450	450
60 lbs of Mg. use	350	540	540	1000	650	500	120	540	540
70 lbs of Mg. use	410	640	640	1200	800	600	140	640	640
80 lbs of Mg. use	470	730	730	1300	900	650	160	730	730
90 lbs of Mg. use	530	820	820	1500	1000	750	180	820	820
100 lbs of Mg. use	590	910	910	1700	1100	850	200	910	910
125 lbs of Mg. use	735	1140	1140	2000	1400	1000	250	1140	1140
150 lbs of Mg. use	880	1360	1360	2500	1600	1250	300	1360	1360
175 lbs of Mg. use	1030	1590	1590	3000	2000	1500	350	1590	1590
200 lbs of Mg. use	1180	1820	1820	3300	2200	1650	400	1820	1820
240 lbs of Mg. use	1410	2180	2180	4000	2700	2000	480	2180	2180

$$\text{Mg} \times 1.6 = \text{MgO} \quad \text{MgO} \times 0.6 = \text{Mg}$$



FactSheet

Extension

Ohio State University Extension Fact Sheet

School of Environment and Natural Resources

2021 Coffey Road, Columbus, Ohio 43210

Soil Acidification: How to Lower Soil pH

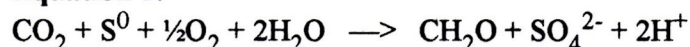
AGF-507-07

Robert Mullen, Edwin Lentz, and Maurice Watson

Many plant species require acid soil conditions to thrive. Throughout Ohio and many other parts of the Midwest surface soils are neutral to slightly alkaline. Elemental sulfur can be applied as a soil amendment to decrease the pH or acidify such soils. Due to the cost, the application of sulfur to acidify soils is more practical for horticultural crops than agronomic crops. The objective of this fact sheet is to provide interested individuals (agronomic and horticultural) with rates necessary to adjust soil pH.

Sulfur reaction in the soil is slow, and quick changes in soil pH should not be expected. It may take a few months or longer to change soil pH to the desired level because the process of sulfur oxidation (conversion of elemental sulfur to sulfate) is the result of microbial activity. Elemental sulfur should be incorporated to increase the speed of oxidation. Since the oxidation of sulfur is the result of microbial activity, fall and winter applications are not advisable (it can be done but changes in soil pH will not occur). Equation 1 shows the chemical process by which sulfur (S) application results in release of hydrogen ions (H^+) to change soil pH:

Equation 1:



Addition of elemental sulfur to soil produces two hydrogen ions, which can be seen from Equation 1 (Havlin et al., 1999). The hydrogen ions released cause soil pH to decrease. Soil pH is, after all, simply a measure of the hydrogen ion concentration in soil solution, and the higher the concentration, the lower the soil pH.

If the soil is calcareous (contains free calcium carbonate), additional sulfur will be required to neutralize the free calcium carbonate. To neutralize a soil that contains 2% calcium carbonate, for example, requires 6 tons of sulfur per acre (this only neutralizes the calcium carbonate; additional sulfur will be

needed to affect a change in soil pH). Obviously, it would be impractical to apply enough elemental sulfur to alter soil pH of calcareous soils on a field scale. Soils of Eastern Ohio typically do not contain free calcium carbonate, but there are soils in Western Ohio that do. Assuming there is no free calcium carbonate, the amount of elemental sulfur needed to lower soil pH is given in Table 1. Note that the amount of sulfur required to lower soil pH varies depending upon soil texture.

To convert the recommended rates from pounds per acre to pounds per 1000 ft² divide the values in Table 1 by 43.56. To adjust the pH of a soil with a measurable volume, use Equation 2 to determine the rate of sulfur needed:

Equation 2:

$$\text{Calculated rate (lb/volume)} = \text{sulfur recommendation (lb/A)} \div 37,635,722 \times \text{soil volume (in}^3\text{)}$$

When using Equation 2, the sulfur recommendation is determined from Table 1, and soil volume is the volume (in cubic inches) of soil in the container. If acidifying the entire volume of soil (which may be possible if the container is small enough), mix the sulfur with the soil thoroughly. If the sulfur cannot be adequately mixed with the entire volume of soil, then determine the area of the container (in square inches – width * length) and determine to what depth the sulfur can be incorporated (measurement in inches). Calculate the volume of soil (in³) and use Equation 2 to determine the new sulfur rate. For example, if attempting to acidify soil in a container that is 36 inches in diameter to a depth of 8 inches and the recommended rate of sulfur (based on initial soil pH) is 360 lb sulfur per acre, it would require 0.08 lb of sulfur be mixed with the top 8 inches of soil (360 ÷ 37,635,722 x 8143). For a deep rooted crop this may not acidify the entire volume of soil, so multiple applications over time will probably be necessary. Remember, soil pH adjustment will not happen quickly, so give the material time to react.

Table 1. Rates of elemental sulfur required to decrease soil pH to a depth of 6 inches.			
Desired change in pH	Application rate based on soil texture¹		
	Sand	Silt loam	Clay
	----- lb S/A -----		
8.5 to 6.5	370	730	1460
8.0 to 6.5	340	670	1340
7.5 to 6.5	300	600	1200
7.0 to 6.5	180	360	720
GIANT PUMPKIN GROWERS			
8.5 to 5.5	830	1660	3310
8.0 to 5.5	800	1600	3190
7.5 to 5.5	760	1530	3050
7.0 to 5.5	640	1290	2580
¹ Assumptions—cation exchange capacity of the sandy loam, silt loam, and clay soil are 5, 10, and 20 meq/100 g, respectively; soils are not calcareous.			

Soil pH adjustments with elemental sulfur should be monitored over time with routine soil sampling and analysis. This will ensure that the sulfur applied is having the desired effect on soil pH. Soils that are overacidified due to sulfur application (soil pH is lower than desired) should be limed to neutralize soil pH to the desired soil pH level. Soils that are underacidified (soil pH is higher than desired) should

receive additional sulfur. Once the soil pH has been acidified to the desired level, the soil pH should remain low for a fairly long period (greater than 5 years). It may not be definite, so monitoring of soil pH with soil sampling is important.