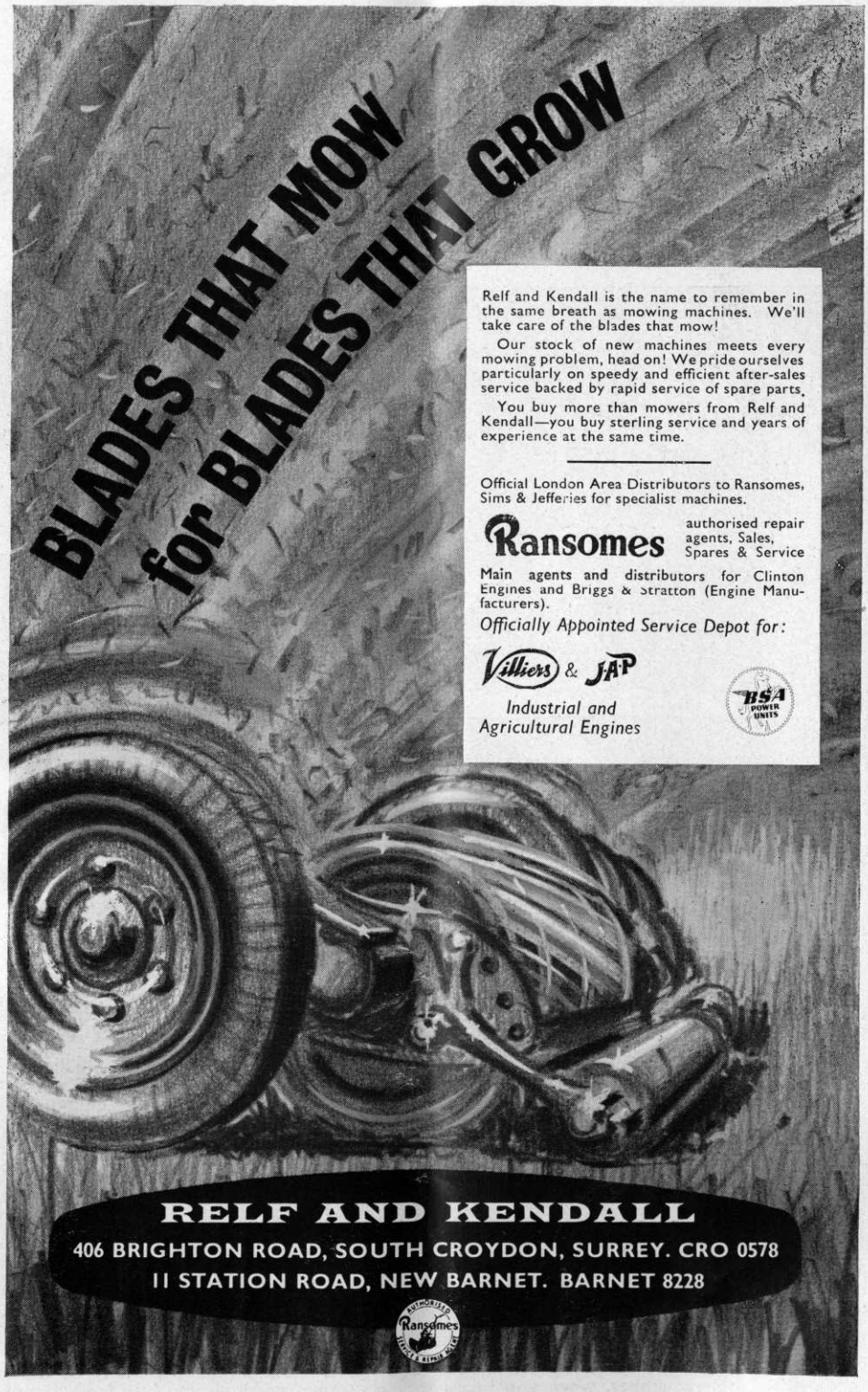
BLADES THAT MOW
for BLADES THAT GROW
Relf and Kendall is the name to remember in the same breath as mowing machines. We'll take care of the blades that mow!
Our stock of new machines meets every mowing problem, head on! We pride ourselves particularly on speedy and efficient after-sales service backed by rapid service of spare parts.
You buy more than mowers from Relf and Kendall—you buy sterling service and years of experience at the same time.
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THE BRITISH GOLF

GREENKEEPER

HON. EDITOR : F. W. HAWTREE

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No. 244 New Series

JULY 1965

DRIVING AND DRIVING

There are brakes to press, a wheel to grip,
A gear to change and lights to dip.
Gas is flowed to exacting measure,
By slightly applying pedal pressure.
I manage all, mistakes are nil,
If I could but drive with equal skill.

—DAMON KNIGHT

JULY

CONTENTS

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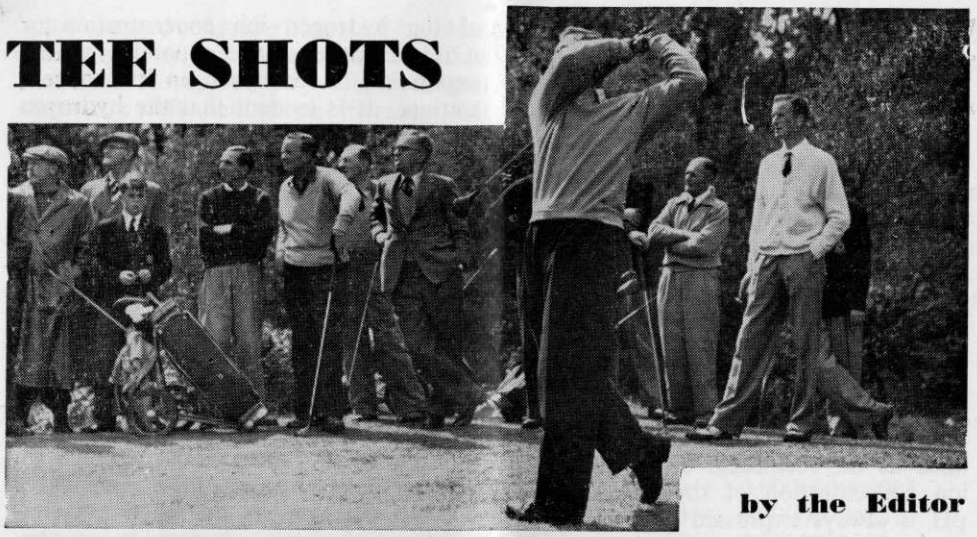
TEE SHOTS



by the Editor

Experiment

The Taunton and Pickeridge Golf Club is carrying out trials with Econal and Regulox this year with a view to reducing the special problems of upkeep which affect their course. Limestone quarrying in the past has left a legacy of small steep ridges and hollows which would be little trouble by the sea but which grow lush inland and require much hand labour. There is also an area of brushwood in the angle of the dog-leg 17th which is a playing feature of the hole but grows vigorously and has to be thinned out each year.

Econal is a 2-4D; 2, 4, 5, 5T oil-borne emulsion which will destroy brushwood roots in a matter of months.

Regulox is a maleic-hydrazide based growth retarder. It is expected that this material will prevent the development of ragged, untidy growth.

* * *

Extension

The Warwick Corporation has added a miniature " hazard " golf course to the putting green and short 9-hole course in St Nicholas Park. But this one is made of concrete and brick and was designed by the Architect's Department. It cost £500.

* * *

Concession

Bulwell Forest Golf Club have gained permission from the Nottingham Corporation to play on Sundays, after 75 years. But permission is only for a ten-months' trial period and play must stop at tea-time. The problem is the public, not Sunday observance. Local inhabitants wander freely over the common-land at week-ends and the Corporation fears for their safety.

* * *

Ace

Tom Mason has celebrated his recent retirement by holing in one at the 192-yard 13th at Hendon during the club's match against Mill Hill. Tom has been within inches of an ace several times, but has not previously seen his tee-shot disappear into the hole.

WHY TURFGRASS RESPONDS TO PROPER USE OF LIME AND SULFUR COMPOUNDS

By Dr ELIOT C. ROBERTS
Turfgrass Speciaiist,
Iowa State University,
Ames, Iowa

With grateful acknowledgements to "The Golf Course Reporter"

What does pH really mean?

WE know a soil may be either acid, neutral or alkaline, and that the degree of acidity or alkalinity is expressed as pH. Technically pH is defined as the reciprocal of the hydrogen ion concentration of the soil solution. pH is always expressed as a numerical exponent (a logarithm) to the base 10.

In the instance of 10^6, the 6 is the numerical exponent or logarithm (pH) and 10 is the base. These pH numbers form a scale which extends from 0 to 14 and the numbers are so arranged that at the point where the concentration of hydrogen ions equals the concentration of hydroxide ions a condition of neutrality exists. At this point the solution is neither acid nor alkaline. One liter (1 gallon = 3.78 liters) of any neutral solution will contain a concentration of hydrogen ions equal to 10^{-7} or 0.0000001 gram (1 pound = 454 grams) of hydrogen ions per liter. The reciprocal of this is 1/0.0000001 or 10,000,000 or 10^7 and the logarithm of this is 7.0. An acid solution with a pH of 6.0 will contain 10^{-6} or 0.000001 gram of hydrogen ions per liter. The reciprocal of this is 1/0.000001 or 1,000,000 or 10^6 and the logarithm is 6.0. An alkaline solution with a pH of 8.0 will contain 10^{-8} or 0.00000001 gram of hydrogen ions per liter. The reciprocal of this is 1/0.00000001 or 100,000,000 or 10^8 and the logarithm is 8.0. It can be seen that an acid solution contains a higher concentration of hydrogen ions than an alkaline solution (0.000001 gram is greater than 0.00000001 gram).

In comparison with common units of weight these amounts are extremely small. It also may be noted that the pH as a whole number is the same as the number of zeros in the reciprocal of the hydrogen ion concentration or it is the same as the exponent in that expression of the hydrogen ion concentration. It is evident that the hydrogen ion concentration at each pH unit is 10 times greater than the next higher unit or 10 times smaller than the next lower unit. For example, as pH levels increase from 1 to 2 to 3 to 4 the hydrogen ion concentration decreases 10 times from 1 to 2, 10 times more from 2 to 3, and 10 times more from 3 to 4 or the hydrogen ion concentration decreases 100 times from 1 to 3 or 1,000 times from 1 to 4. This indicates that a small change in pH actually represents a rather large change in hydrogen ion concentration (See Table 1). In addition, as hydrogen ion concentration increases, hydroxide ion concentration decreases.

How do Soils become Acid?

Factors which influence soil acidity may be classified in three groups:

1. Soil Properties
2. Biological influences.
3. Climatic influences.

Soil Properties

Soils composed of minerals high in calcium and magnesium resist tendencies to become acid. The same acid forming processes go on in these soils that take place in other soils. However, these calcium soils have a built-in supply of lime which is effective in neutralising acidity as it forms. In general, processes of weathering, decomposition of organic matter, exchange of bases on colloidal soil systems, cropping, accumulation of fertilizer residues and leaching influence soil pH. These processes result in the formation of acid silicates, mineral acids, acid salts and organic acids which tend to increase soil acidity.

Biological influences

Plant roots release hydrogen in their respiratory processes. Since respiration is an essential feature of all living matter, the release of hydrogen in the soil is particularly large where organic matter levels are high and the soil is active biologically (contains a large number of microorganisms). Calcium, magnesium potassium, and sodium, all

plus charged ions, are obsorbed by plant roots and by microorganisms and thus removed from the soil while hydrogen ions are left behind to increase soil acidity.

Climatic influences

The plus charged ions; calcium, magnesium, potassium, and sodium are subject to leaching from soils where rainfall or irrigation practices result in excesses in soil moisture at various periods throughout the year. In such instances these ions are washed out of the topsoil into the subsoil where they are drained away and lost. Hydrogen ions accumulate in these situations and soils tend to increase gradually in acidity. Where rainfall is in excess of 20 inches a year and where calcium and magnesium contents of the soil are low, soil acidity is likely to be a major problem. Putting greens and tees which are watered regularly are particularly susceptible to development of acid conditions.

In areas where the total yearly rainfall is light and where large amounts of precipitation seldom occur these basic elements (calcium, magnesium, potassium, and sodium) do not leach away but accumulate in both the topsoil and the subsoil. Often in these locations irrigation water is relatively high in basic ions and the use of such water increases further the concentration of these elements. Under such conditions, soils gradually increase in alkalinity.

Table 1. — The pH Scale

pH Reading	Hydrogen Ion Concentration*		Hydroxide Ion Concentration*	
0 Acid	10^{-0}	1.0	10^{-14}	0.00000000000001
1 |	10^{-1}	0.1	10^{-13}	0.0000000000001
2 |	10^{-2}	0.01	10^{-12}	0.000000000001
3 |	10^{-3}	0.001	10^{-11}	0.00000000001
4 |	10^{-4}	0.0001	10^{-10}	0.0000000001
5 |	10^{-5}	0.00001	10^{-9}	0.000000001
6 |	10^{-6}	0.000001	10^{-8}	0.00000001
7 (Neutral)	10^{-7}	0.0000001	10^{-7}	0.0000001
8 |	10^{-8}	0.00000001	10^{-6}	0.000001
9 |	10^{-9}	0.000000001	10^{-5}	0.00001
10 |	10^{-10}	0.0000000001	10^{-4}	0.0001
11 |	10^{-11}	0.00000000001	10^{-3}	0.001
12 |	10^{-12}	0.000000000001	10^{-2}	0.01
13 |	10^{-13}	0.0000000000001	10^{-1}	0.1
14 Alkaline	10^{-14}	0.00000000000001	10^{-0}	1.0

*Moles per liter (1 mole of hydrogen = 1 gram per liter; 1 mole of hydroxide = 17 grams per liter).

How Soil Acidity and Alkalinity Affect Turfgrass Growth

Turfgrass species and strains differ in their tolerance of acid soil conditions. In general, of the cool season grasses, the bentgrasses are most tolerant, the bluegrasses least tolerant and the red fescues are intermediate. The optimum pH for all these grasses, however, lies between 6.0 and 7.5 Applications of ground limestone to correct acid soil conditions are recommended any time the pH drops below 5.8.

It is important to note the effects of soil acidity and alkalinity on turfgrass production. Plant response often provides the first indication of poor growth conditions in the soil. The following observations have been associated with acid soils.

First, Plant Vigor. Turf grown on acid soil is often more free of weeds, particularly clover than turf grown under neutral or slightly alkaline conditions. Where soils are acid, bentgrasses are often darker green in color and turf is more dense. Not all weeds do better at higher soil pH levels. For example, sheep sorrel and field horse-

Continued: *Page* 10

MIDLAND SECTION v. S. PRESIDENT'S TEAM

HANDSWORTH GOLF CLUB

22nd JUNE 1965

	President's Team			Midland Greenkeepers		
1.	A. Pullar & J. F. Cooke	—	0	G. Woodward & E. H. Benbow	5 & 4	1
2.	J. L. Whitworth & R. Hiatt	5 & 4	1	W. Barton & D. Brazier	—	0
3.	Ian Wheater & R. Kirkby	3 & 2	1	W. Marnock & V. Smith	—	0
4.	P. Skerrett & Rod Davies	3 & 2	1	W. Handy & H. Shepperd	—	0
5.	T. R. Hodgetts & E. Moggs Wright	1 up	1	R. Pugh & T. Jones	—	0
6.	W. N. Dudley Evans & A. H. Clayton	1 up	1	A. Hastelow & H. Drewitt	—	0
7.	C. J. Withers & J. P. Richards	1 up	1	R. Smith & A. Boraston	—	0
8.	C. C. More & W. Leslie Jones	1 up	1	A. Stephens & R. Baxter	—	0
9.	R. J. W. Baldwin & C. Golf	3 & 1	1	G. Smith & A. Underwood	—	0
10.	T. A. Phillips & P. F. Millward	3 & 2	1	E. Walford & J. Rawbone	—	0
11.	L. W. Wheeler & G. N. Adams	3 & 1	1	R. W. Bailey & J. Twigger	—	0
12.	Dr V. E. Milne & N. H. Russell	7 & 5	1	C. Kettle & D. Haynes	—	0
13.	R. Parker	—	0	E. Ballinger	1 up	1
			11			2

A stormy morning gave way to sunshine for the President's match at Handsworth on 22nd June and the course had been polished to the ultimate degree by E. Benbow and his team.

The President fielded ten Warwickshire County players and one from Worcestershire in his team. So the result, 11 against 2 for the Greenkeepers, was not discreditable, especially when four of the matches had only one hole difference in the result.

Seventy-four people sat down to the excellent supper afterwards in the club house. Our Chairman, the Midlands Hon. Secretary, and the Handsworth

Captain amongst them. Mr Bretherton spoke first, gave the result, and gave the apologies including that from Mr Harley Roberts who had torn a muscle playing cricket on the previous Saturday, Mr Charles Stowe and Sir Ernest Canning. He thanked the golf club staff for the splendid meal which had been provided and then called on Mr Millward, the Captain, who welcomed greenkeepers especially, apologised for the result and hoped that the rest of the evening would be as agreeable as the game he had so much enjoyed.

Our Chairman spoke next to express his thanks and was followed by George Hart who thanked our President for his hospitality on behalf of the Midland Section. They all enjoyed this annual match and the opportunity of playing against the cream of Midland Golfers. He paid a very special tribute to Mr Bretherton for all the work which he did on behalf of greenkeeping and greenkeepers. The result might well be due to the fact that the greenkeepers team had a lot of grass to cut before playing the match.

Mr Leslie Foster then moved a vote of thanks to Mr Bretherton on behalf of all those present, not only for his generosity but also for the manner in which he gave it. He congratulated the Warwickshire Union team for qualifying for the County Finals at Burnham and hoped that the President of both greenkeepers and County Union would see a victory for the four members of the team who had also played tonight.

The Captain of the team replied and the Captain of the Club finally proposed a toast to Mr Bretherton which was enthusiastically received.

Results are shown on previous page.

Berk Summer Range

of turf treatments for busy

Watering

'Supplex' Sprinkler

This triple-bore plastic hose is minutely perforated throughout its length. One end is closed so that when the perforations are opened by water pressure, a *fine* rain-like spray is produced which soaks without flooding – in a rectangular pattern. Supplex is the logical choice for rectangular areas. Lengths are available to cover, in one operation, tennis courts, bowling greens and cricket pitches.

'Tricoflex' Reinforced Plastic Hose

For conveying water, Tricoflex is three ways superior to rubber hose. Tricoflex withstands the kind of rough handling that soons destroys a rubber hose; it weathers better – it is particularly resistant to long exposure to the sun – and its light weight and suppleness make it easier to coil and carry. Tricoflex hose is constructed of 3 layers: black P.V.C. inner tube, with mirror finish for optimum water flow, knitted jacket of 'Tergal' polyester fibre and an opaque vivid yellow outer cover of polythene. Tricoflex has been proved in rugged tests on building sites – will last you years!

Moss Control

Berk Moss Control compounds are based on mercury – this is present in an insoluble and harmless form. Mercury not only kills moss but prevents subsequent growth – it can control moss for up to three years. Three compounds are available: the choice depends on the individual requirements and the time of the year.

M.T.S. (Mercurised Turf Sand)
This is applied at 4 oz. per square yard from early spring to late summer. It kills moss immediately, reduces weed population and, because it contains a quick-acting nitrogen fertilizer, stimulates grass growth.

Moss Killer
This is applied at 4 oz. per square yard at any time of the year but especially prior to normal autumn treatments. Moss Killer does not contain a grass stimulant but gives rapid control over moss.

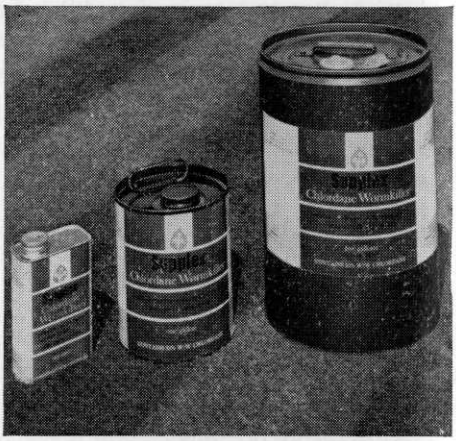
Moss Eradicant
A special formulation to control the following crop of moss while killing the immediate crop gradually – so there is no disfigurement from dead moss.

Hints on Moss Control
1. Moss will always invade and colonise neglected turf.
2. Do not rely on raking alone to remove moss. This spreads moss spores and fragments which can re-infest the site. Always use a moss killer in conjunction with raking.
3. Correct turf management should always be practised. After using a moss killer, the factors responsible for the appearance of moss should be removed.
4. Some common causes for the appearance of moss are:
*Poor drainage and aeration *Bare patches *Over-rolling and compaction *Acid and undernourished soils *Persistent close mowing.

TA2078

groundsmen & greenkeepers

Wormkiller



Berk 25% Chlordane Wormkiller

Supplex Chlordane kills worms *underground* and kills leatherjackets, ants and chafer grubs. It is cheap and easy to apply – calling for very little watering and minimum labour. Best applied in warm, showery weather during autumn or spring when worms are most active and near the surface

Berk 20% Chloride Wormkiller (Granular)

Applied at 80 lb. per acre, this form of Chlordane is particularly useful where grass is kept long or the sward is thick.

Fertilizers

'Thrive'

A balanced organic fertilizer with the essential trace elements, in pellet form. Ideal for ornamental borders. Applied as base dressing at 4 oz. per square yard and as top dressing at 2 oz. per square yard.

Turf Fungicide

Berk Turf Fungicide

This fungicide contains the equivalent of 2½% Mercury and gives excellent control of Fusarium Patch (F. Nivale) and Dollar Spot (Sclerotimia Homeocarpa) in Turf. It should be applied in late Summer and Spring for the control of Fusarium, or when symptoms appear in the case of Dollar Spot. Apply as a powder or dispersed in water.
Spray. 1 oz. in 2 gallons of water applied through a watering can or sprayer is sufficient for 40 sq. yds. of Turf.
Dry Method. 1 oz. can be mixed with 14 lb. of Sand or finely divided soil and applied to 40 sq. yds. of Turf. It is important not to exceed the recommended rates or damage may result. To assist in obtaining complete control, healthy grass growth should be encouraged.

POST THIS COUPON NOW FOR LEAFLETS AND PRICES

F. W. Berk and Co. Ltd, Berk House, 8 Baker Street, London, W.1 Telephone: HUNter 6688

Please send me literature and prices for the following (tick as appropriate).

☐ **Supplex** ☐ **Tricoflex** ☐ **Moss Control** ☐ **Wormkiller** ☐ **Fertilizer** ☐ **Fungicide**

NAME.....**POSITION**.....

ADDRESS.....

(B.G.G./3)

.....

from page 5

tail grow best on acid soils; also bentgrasses and fine leafed fescues grown under non-irrigated conditions perform best under acid soil environments.

Second, Injuries. Turf grown on acid soil has been found more susceptible to winter kill, more prone to injury from applications of chemicals such as arsenic and less reliable under adverse climatic conditions. These growth responses are believed to be primarily due to a weakened condition within the plant when grown on acid soils.

Third, Thatch. Turf is more likely to develop thatch and to become root bound on acid soils. Soil microorganisms are affected by the pH of their environment. Decomposition of organic matter, ammonification, nitrification and nitrogen fixation are carried out more effectively where soils are properly limed. For example, the activity of nitrifying organisms declines with pH much below 5.5. It is known that earthworms and bacteria are less active under acid conditions while fungi are more active. Since bacteria activity is reduced in acid soils and these microorganisms are effective in the breakdown of organic residues, thatch accumulates where soils are acid. In addition, the normal decomposition of thatch results in the production of organic acids which as they accumulate may further suppress the rate of organic matter breakdown. Applications of two to five lb. of fine ground limestone or of hydrated lime per 1,000 square feet are of value in correcting soil acidity so that these processes may continue.

Fourth, Disease. Acid soils have been correlated with increased incidence of dollar spot, brown patch and snow mould diseases. It is likely that increased fungal activity under acid soil conditions is responsible for these observations.

Fifth, Drought. Drought tolerance of turf is less where soils are acid. This may be related to decreases in depth and distribution of root systems in acid soils.

It has been concluded that soils may readily become too acid for the best growth of fine turf and that in the long run maintenance of soil pH levels between 6.0 and 7.5 is most desirable.

Why Soil Acidity and Alkalinity Affect Turfgrass Growth

Acid soils may be detrimental to plant growth directly by presenting hydrogen ion concentrations which are too high. Since the pH of cell sap in roots of plants varies from 4 to 6 it is not believed that this effect is of great importance. It is more likely that aluminium and manganese toxicity or calcium and magnesium deficiency are responsible for most acid effects on plant growth. Aluminum hydroxides may form in the conductive tissues thus clogging them to the detriment of plant function. Calcium is recognised as essential for the production of strong vigorous roots, for cell wall construction, to promote translocation of carbohydrates and mineral elements, to control absorption rates of minerals by roots and to bring about balances in the chemical acidity within cell fluids. Magnesium functions in similar processes and in addition is an essential component of the chlorophyll molecule. The use of lime to correct deficiencies of calcium and magnesium may be important on some soils. It should be remembered that the over use of lime may aggravate deficiencies of other elements such as boron.

In addition, soil acidity affects availability of essential nutrients and is related to the development of physical soil conditions which may be detrimental to plant growth.

Soil Variability. It is often noted that soil acidity varies considerably from location to location on turfgrass areas of various sizes. This results in a spotty or patched growth response which is characteristic of pH related causes of poor turf production. In this regard it has been found that from 550 to 1,000 lb. of limestone per acre may be removed annually in drainage water. Pockets which are excessively well drained may be large in area or restricted in size and become more acid than surrounding locations.

Seasonal Effects. Variations in pH are likely to occur with time of year.