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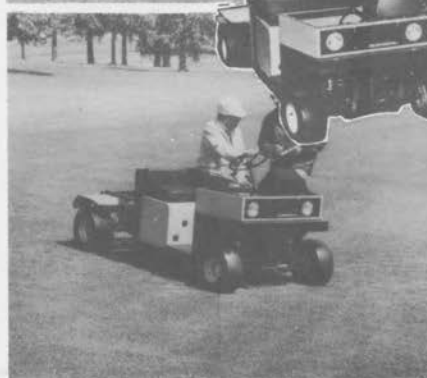
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Potassium, Calcium, Magnesium— How They Relate to Plant Growth

by Carl Schwartzkopf, Mid-Continent
Agronomist, USGA Green Section

Potassium, calcium and magnesium play an important role in soil-plant relationships. These elements are not only essential to the complex biochemistry of plant growth, but their presence in the soil in adequate amounts and in suitable proportions to one another and to the other exchangeable cations, such as aluminum, hydrogen and NH_4^+ , is necessary if the soil is to be a suitable medium for plant-root development. Should one element be in excess, it may "tie-up" or make it unavailable to the plant.

POTASSIUM

Potassium is absorbed by plants in larger amounts than any other mineral element except nitrogen and possible calcium. This element plays an important part in many of the vital physiological processes in the plant; the exact mechanism by which potassium functions is not known. It is needed for the plant cell's metabolic processes and apparently has a role in influencing the uptake of certain other mineral elements, in regulating the rate of respiration, affecting the rate of transpiration and in influencing the action of enzymes, as well as in aiding the synthesis and translocation of carbohydrates, thereby encouraging the cell walls to thicken and help the plant to remain upright.

Potassium plays a vital role in the winter survival of turfgrass, disease resistance, and in increasing the overall hardness of the grass plant. Deficiency symptoms of potassium on turfgrass are yellow-streaked leaves, followed by browning and dying at tips and margins.

SOURCES OF POTASSIUM

Hardwood ashes supplied much of the potassium in the United States through the first part of the 19th Century. A decline in the potash industry

resulted after the hardwood forests along the Atlantic Coast were depleted. The first factory that processed KCL (murate of potash) was in Germany, and the Germans monopolized the potassium market until World War I. The embargo placed on potassium exports forced development of the resources of the United States and of other countries as well. Most potassium today comes from New Mexico, California, and Utah.

CALCIUM

Calcium, as potassium, is absorbed by the turfgrass plant in the ionic form. The calcium in the soil other than what was added as lime or in fertilizer material originated in the rocks and minerals from which the soil was formed. Calcium is a part of many minerals, such as dolomite, calcite and calcium feldspars. Upon their disintegration and decomposition, calcium is released.

Calcium is an extremely important mineral in plant nutrition. Many soils, particularly in humid regions, contain this element in amounts so small that

Continued on Page 16



Remember when Miller's had a Lawnmower on their roof?

The Triplex Ring

The advent of the triplex putting green mower in the late 1960's brought with it great expectations for reducing labor costs while at the same time improving the quality of putting green turf. For many of the golf courses that use triplex mowers, this dream has been at least partly realized; the number of hours needed to mow the greens has been greatly reduced and turf quality has not suffered significantly. For others, however, the triplex mower has been a mixed blessing. Though time spent mowing greens has been reduced, extra effort has been needed to cope with new problems associated with the use of the triplex. For example, the wear and compaction caused by turning the triplex mower off the green after each pass may demand that the collars be aerated and topdressed more frequently and hand-watered regularly. Collars are often scalped when units are lowered too quickly or raised belatedly at either end of the pass. There are also the mechanical malfunctions, when individual units on the triplex refuse to rise upon command and when hydraulic lines leak or burst, creating unsightly turf damage which may last for weeks or months. Perhaps the most common problem associated with the use of the triplex mower is a condition which could be entitled, for lack of a better term, the "triplex ring." It is best described as

the ring of weak, scalped or dead grass around the perimeter of the gree, in the area where the triplex mower makes its final cleanup pass. The reasons for this problem are easy enough to appreciate. This perimeter ring is the only area to receive double traffic each day the greens are mowed, once when the mower is making its straight passes across the green and again when it makes the cleanup cut. It is also the only part of the green where the mower travels the same path every day, thereby compounding the wear and traffic problems imposed upon it as compared to the other turf areas on the green.

Finally, the cleanup pass is the only time that the mower is actually turning on the green itself, a situation similar to turning mowers at the ends of fairways and tees. In each case, the mower creates downward and lateral pressures during the turn which combine to produce greater wear and soil compaction than if the machine were traveling in a straight line. The sudden turning of a golf cart on wet fairway turf is a more dramatic illustration of this principle. There seems to be no single solution to the triplex ring situation, in many instances, but there are a number of practices which when combined can help to alleviate the problem.

Cultivation and Cultural Manage-

Continued on Page 14



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18 Ways of Mis-Using Equipment

Remember this is what takes place when you mis-use equipment.

1. Run equipment at excessive speeds. Result - poor cutting appearance.

2. Run equipment with loose bolts and nuts. Result - (a) bolts will become elongated due to vibration. (b) bolts and nuts when lost usually end up between the reel and the bed knife.

3. Run equipment improperly adjusted, such as: (a) belts and chains, (b) clutches, (c) reel and bed knife. Result - (a) Wear out prematurely and cause undue wear to pulleys, sprockets and bearings (b) wear clutch plates and linings, (c) will not cut properly and will wear bed knife and reel prematurely.

4. Operate with accumulation of grass clippings and dirt in air cooling fins on engine. Result - will cut out flow of air causing engines to run excessively warm. May cause fires.

5. Operate equipment not properly lubricated. Result - bearings, shafts, sprockets and all wearable parts will not stand up. This will cause poor performance of any equipment.

6. Operate engine with little or no oil in crankcase. Result - connecting rod will seize in cylinder.

7. Operate engine with air - cleaner empty. Result - will affect carburetion giving poor engine performance and shorten life of engine due to dirt entering engine.

8. Using improper equipment for the

job. Example - using a light duty piece of equipment where a heavy duty should be used. Result - poor finished job and equipment will not stand the gaff. Example would be - sending a boy to do a man's job.

9. Using improper fuel in engines such as white gas, etc. Result - manufacturer's recommended standard gasoline, and substitutes will cause poor engine performance, also wear engine prematurely.

10. Operating equipment with faulty parts. Result - one worn or missing part will possibly wear five others causing expensive maintenance costs.

11. Using heavy detergent oil in engines or number 10 weight oil. Result - manufacturer's recommend non-detergent oils and number 10 is too light due to the high r.p.m. under which engines operate.

12. Operate any rotary mowing equipment with cutter bar out of balance. Result - will cause undue vibration and wear bushings, bearings and could crack housings.

13. Use reel type mowers where there is any stones, or debris. Result - tear up reels giving poor cutting appearance.

14. Over grease or use wrong lubricant. Result - excessive grease or wrong lubricant will fall on turf harming grass.

Continued on Page 13

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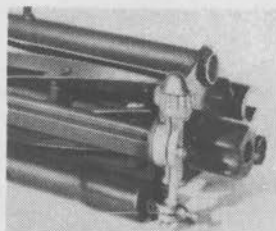
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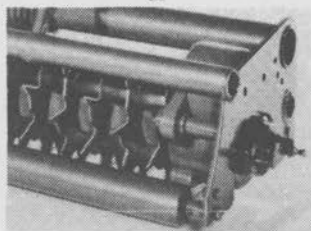
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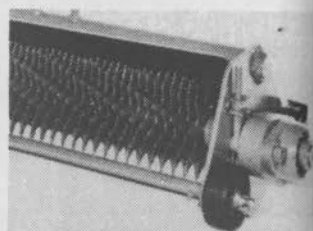
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Turfgrass Research Center Unveiled

The new Hancock Turfgrass Research Center was introduced to the University community yesterday, Sept. 10, 1981, at a morning open house and dedication.

Located at the corner of Farm Lane and Mt. Hope roads, the facility is the product of cooperative efforts of the turfgrass industry and the University. "It will provide opportunities to conduct research which we couldn't do previously because of space and equipment limitations and efficiency problems," says Paul Rieke, turfgrass specialist in the Department of Crop and Soil Sciences.

Research plots were formerly scattered around campus. Though some of those will be maintained, the major emphasis will be on the nine acres surrounding the new building.

One section of land will be used for research on turf maintenance of home

lawns, parks and athletic fields. Another section will be used to study more intensively maintained turfs such as those found on golf courses. A third section will deal with the developments of new varieties of red fescue, a species of grass that can be adequately maintained with low energy inputs.

An important function of the research center, Rieke says, is the testing of new varieties to determine their adaptability to Michigan conditions. This information is then provided to homeowners, sod farmers, golf course superintendents, athletic field and parks supervisors, and others interested in turfgrass management.

"In our research," he says, "we're looking for adapted grasses and the proper management of those grasses for minimum maintenance in order to maintain an esthetic, functional turf."

Continued on Page 18

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Is-Using Equipment, Cont .

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6. Drain engine oil when cold. Result - sediment in oil is not in suspension and will settle to the bottom of the pump. If drained when warm, 90% of the sediment will flow out.

7. Spray water on cylinder head and cylinder when cleaning equipment that is hot. Result - will cause warpage and may crack head or block.

8. Mis-use of equipment such as: (a) hitting obstructions, (b) jumping curbs, (c) transporting walking greens-mowers on roller.

Ted Lazaroff



Old-time member and friend of Michigan & Border Cities GCSA — Passed away January, 1982.

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Triplex Ring, Cont. ment

Getting back to the basics of turfgrass management, the development of a strong, healthy grass is the best way to resist triplex ring damage. Avoid overwatering and overfertilizing at all costs. Too much water and nitrogen can create a weak, lush turf which is more susceptible to wear injury. Wet soils also compact much more readily, inhibiting root development and resulting in a weakened turf.

To overcome the effects of compaction and wear in the perimeter ring, aerate the soil more frequently. If the greens are already aerified once or twice during the season, then aerate the perimeter ring by itself several other times. Aerating (coring) achieves positive results even when done in the middle of a stress period, so don't hesitate to aerify if triplex ring symptoms began to appear. If chronic soil compaction problems are related to the texture of the soil in the greens as well as to the use of the triplex mower, then begin modifying the soil in the greens by topdressing with a compaction-resistant material, one containing a high percentage of sand. Have the topdressing material tested by a soils laboratory in order to insure proper infiltration rate, pore space and bulk density.

Design and Environmental Factors

Most of the time the symptoms of triplex ring will not appear uniformly around the perimeters of all the greens. Weakness or injury is most likely to develop in areas of the perimeter ring where other stress factors also come into play. Sharply contoured greens often develop this malady, especially where the mower makes its sharpest turns during the cleanup pass. Sometimes this problem can be resolved by recontouring the green so that sharp turns are eliminated.

Triplex ring symptoms often manifest themselves on greens only in entrance and walk-off zones, especially when traffic is restricted to narrow passageways by steep banks, sand bunkers or other obstacles. If the area around the green can be redesigned to provide several different entrance and exit channels, very often the triplex ring will

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Triplex Ring, Cont. disappear.

The presence of trees near a green may create enough extra turf stress to produce visual symptoms in the area of the perimeter cut. Too much shade, poor air circulation and tree root competition all weaken the resistance of the turf to the additional wear of the triplex mower. Removing or thinning some of the nearby trees in order to improve sunlight penetration and air circulation will usually help alleviate the problem. The trees should be root-pruned by digging a trench between the trees and

green, placing tarpaper or some other heavy-duty material in the trench and backfilling.

There are many types of stresses which may have a detrimental effect on the health and vigor of putting green turf. By carefully investigating the causes of this stress, adjusting mowing and cultural programs accordingly, and creating a favorable environment for plant growth, some of the problems associated with the use of the triplex putting green mower can be eliminated.

*James T. Snow, Agronomist
USGA*

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plant growth is limited. Turfgrasses as a group are able to tolerate low levels of calcium; however, abnormal growth has been observed with extremely low levels. One of the primary roles assigned to calcium is also important in root development, since short roots are observed on calcium deficient plants. The first sign of calcium deficiency in older plants is the appearance of a reddish-brown discoloration in the tissue between the veins, along the margin of the blade. The most obvious method of correcting this deficiency is by the application of calcitic or dolomitic lime. Should calcium be required without changing the pH that would result from the use of lime, gypsum may be used.

Liming is the addition to the soil of any calcium-containing compound that is capable of reducing acidity. The correct use of lime refers only to calcium oxide (CaO), but the term almost universally includes such materials as calcium-magnesium carbonate and calcium carbonate, calcium-magnesium carbonate and calcium silicate slags. A description of various liming materials describing their availability and manufacture follows:

Calcium Oxide - Calcium oxide (CaO), also known as unslaked lime, burned lime, or quicklime, is a white powder that is quite disagreeable to handle. It is manufactured by heating calcite limestone in an oven or furnace. The carbon dioxide is driven off, with calcium oxide remaining. This product is most frequently handled in paper bags because of its powdery and caustic nature. This material reacts quickly when added to the soil. When unusually rapid results are desired, either calcium oxide or calcium hydroxide should be used.

Calcium Hydroxide - Calcium hydroxide (Ca(OH)₂) is commonly referred to as slaked lime, hydrated lime or builder's lime. It is similar to calcium oxide in that it is a white powdery substance, difficult and unpleasant to handle. Slaked lime is prepared by the hydration of calcium oxide. A large amount of heat is generated; upon completion of the reaction, the material is dried and packaged.

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MAGNESIUM

Magnesium is also absorbed by plants in the ionic forms. This absorption takes place from the soil solution or possibly by contact exchange.

Magnesium plays a vital role in photosynthesis, as it is the central atom in the chlorophyll molecule. It is involved in many enzyme reactions. It reacts with phosphorus in uptake and transport. Magnesium is also quite mobile in the plant, and yellow deficiency symptoms first appear on the older leaves, as it moves to the younger plants.

SOURCE OF MAGNESIUM

Magnesium in the soil originates in the decomposition of rocks containing minerals such as brotite, dolomite and olivine. Upon decomposition, these minerals set magnesium into the surrounding soil solution. Once in the soil solution, magnesium may be 1) leached, 2) absorbed by living organisms, and 3) absorbed by surrounding particles.

MAGNESIUM IN THE SOIL

The coarse-textured soils of the humid region are those in which a magnesium deficiency is generally manifested. These soil types usually contain small amounts of exchangeable magnesium. This condition is aggravated by the addition of large quantities of fertilizer salts which contain little or no magnesium. The magnesium in the soil is released by ion exchange when these fertilizers are added; the larger quantities of chlorides and sulphates speeds its removal by leaching. Magnesium can be supplied in dolomitic limestone, or as magnesium sulphate, if soil pH is to remain the same. A deficiency of magnesium is less of a problem on finer-textured soils and on soils found in the arid regions. In some semi-arid location, magnesium compounds may actually be precipitated in the soil profile.

When the appearance of a plant and environmental factors indicate a nutri-



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tional disorder, steps should be taken to verify the problem before attempting to correct it haphazardly with nutrients that are not needed. Since nutrient deficiencies on turfgrasses are difficult to visually diagnose, a suspected deficiency should be verified with soil or tissue tests before trying to correct the problem. A most important criterion for a soil test is that it should measure the nutrient in the soil that is available to the plant. Many times nutrients in the soil are held tightly and are unavailable.

Research Center, Cont.

Mowing, fertilizing, watering, and disease and pest control are just a few of the factors to be studied, he notes, the goal is to develop maintenance programs that require less energy and water and protect the environment, too.

Much of the preliminary organization of the facility was directed by John Kaufmann, also a turfgrass specialist in the Department of Crop and Soil Sciences, who says the research center development costs will exceed \$475,000.

The land, some of the labor and a part of the cost of the building were donated by the University, he notes. The major input, however, has been from private donors and companies related to the turfgrass industry.

Robert W. Hancock, owner of Hancock Industries in Jackson, left a portion of his estate to MSU for the development of a turfgrass research center. His donation amounted to around \$160,000. The Michigan Turfgrass Foundation has also been instrumental in the lab's development and, in fact, provided the

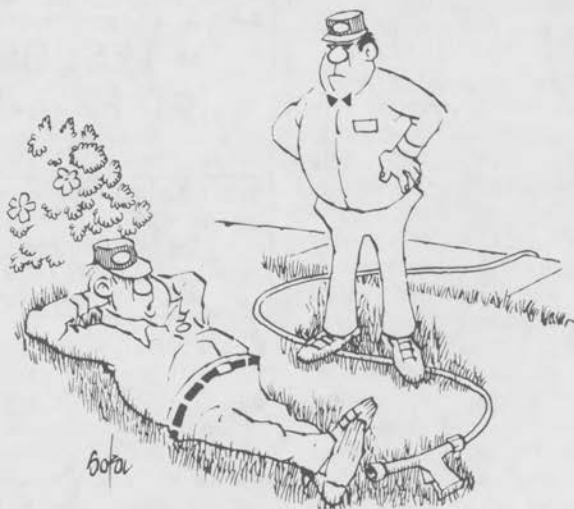
contact with Hancock. It has helped to equip the building and generated support for the facility within the industry. As a result of the foundation's activities, a number of companies, both national and state distributors, have contributed equipment, including mowers, irrigation systems, earth movers and other machinery. Materials including drainage tile and sand needed to modify soil, have also been donated.

Volunteers, ranging from students to golf course superintendents and parks people, have contributed much of the labor.

"It's been a huge effort by a lot of people," Kaufmann says, adding that the facility is a significant development during hard times. These donations encourage research, he says, and enable the training of students in the turfgrass field.

"It's a case of the industry's working closely and cooperatively with the University to make this an outstanding research facility," he explains.

*Susan Fairman
MSU Staff*



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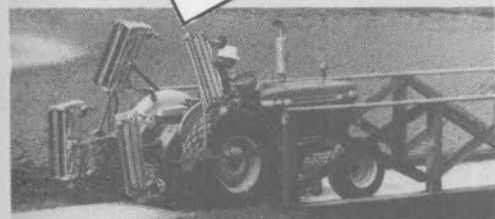
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