Fertilizer and Lime Usage In Bent Green Care

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The principal fertilizer materials were enumerated and described briefly in June 1947 GOLFDOM. They can be used as such, singly or in combination; or they can be applied in commercial fertilizer mixtures. The manufacturer of mixed fertilizer uses these components in appropriate amounts to produce a mixture with a definite analysis. The resulting product is called a fertilizer grade. Each state has a list of approved grades and frowns upon the manufacture of any others. The approved grade of lawn and garden fertilizer is 4-12-4 in the mid-west, 5-10-5 for the East and 6-10-4 on the Pacific Coast. Each fertilizer manufacturer is permitted to make one additional grade of mixed specialty fertilizer of his own choosing.

Accepted practice is to show the percentage content of the 3 major constituents in the order of nitrogen, phosphorus and potassium. Nitrogen is expressed as such; in other words as the element. Phosphorus is given as the percent of phosphorus pent oxide (P_2O_5) which is called phosphoric acid by the trade. Phosphorus pent oxide unites with water to form phosphoric acid, and with lime to make calcium phosphate. Superphosphate is a lime phosphate. The oxide of potassium (K_2O) is called potash. A 4-12-4 fertilizer contains 4 percent nitrogen, 12 percent phosphoric acid and 4 percent potash. An 0-9-27 has no nitrogen, but contains 9 and 27 percent respectively of phosphoric acid and potash.

Understanding the Mixture

Confusion in terminology can be avoided by remembering that phosphorus and potassium are the names for two chemical elements. The terms phosphoric acid and potash refer to chemical compounds which are combinations of the respective element with oxygen. When phosphoric acid and lime (or any other metallic oxide) combine a phosphate is formed.

Expressing the percentage content of phosphorus and potassium in a fertilizer as phosphoric acid and potash is confusing and misleading in one sense. A 4-12-4 fertilizer has 5.2 percent phosphorus and 3.2 percent potassium and would be a 4-5-3 roughly expressing the constituents as chemical elements. Since the figures 12 and 4 for the oxides are larger the customer may think he gets more for his money. Actually both figures 12% phosphoric acid or 5.2 percent phosphorus, and 4 percent potash or 3.2 percent potassium represent the same quantity of plant food. There is nothing wrong with either method so long as the fertilizer meets or exceeds the guarantee, and the buyer understands the difference between the terms phosphoric acid and phosphorus, or potash and potassium.

Until a few years ago the nitrogen guarantee was expressed, "nitrogen as ammonia." A fertilizer guaranteed to contain 5 percent "nitrogen as ammonia," and one guaranteeing 4.1 percent nitrogen contain the same amount of nitrogen. The old guarantee might lead the customer to believe he was buying more plant food. There was and is a more serious objection to the old phrase. The statement "nitrogen as ammonia" might be interpreted to mean that all the nitrogen in the fertilizer was from materials containing that kind of nitrogen whereas the fertilizer might have several forms such as natural organics, nitrates, cyanamid, urea, etc. The change from ammonia to nitrogen was a forward step.

Difference Between Grade and Formula

The chemical analysis, or grade, expresses the percentage content of essential plant food elements. The formula enumerates the ingredients and the exact amounts of each used to produce a ton of that grade fertilizer. Occasionally the manufacturer reveals this information. The expression "open formula" designates this practice.

Mixed fertilizers are very similar with respect to the source of phosphoric acid and potash. The principal variation is in the source and kind of nitrogen. All the potash is derived from muriate of potash, excepting a few grades made for special crops. Sulfate of potash is used in them. Superphosphate is the principal source of phosphoric acid. It varies in analysis from 16 to 45 percent. Ammonium phosphate is another source which furnishes nitrogen and phosphoric acid. Bone meal was used in the past but is seldom found except in an occasional specialty fertilizer.

Mixed fertilizers differ principally in the kind of nitrogen they contain. In a few mixtures all the nitrogen is derived from sulfate of ammonia, in others it may be a combination of sources. Some contain only water soluble nitrogen derived from sulfate

of ammonia, cyanamid, urea, nitrate of soda, or ammonium nitrate. In others part or all of the nitrogen is water insoluble derived from natural organics such as cotton seed meal, castor pomace, processed leather, etc.

Most turf authorities favor mixtures with one-third to one-half of the nitrogen from these organic sources and the balance principally from inorganic sources, preferably with a large part in the form of ammonia. Most fertilizer manufacturers reveal the amount of water insoluble nitrogen in the mixture. This information is required as a part of the guarantee by some states.

The term units of plant food is frequently used. A unit is 20 pounds. A ton of 5-10-5 fertilizer contains 5 units of nitrogen, 10 units phosphoric acid and 5 units potash, or a total of 20 units. Some states require a minimum of 16 to 20 units of plant food in any grade of mixed fertilizer sold in the state. This provision does not apply to fertilizer materials such as nitrate of soda, or the vegetable meals and the animal tankages.

Sometimes cost per unit of plant food is used to compare the relative value of fertilizers. The method may be fair when the ratio and kind of plant food is the same. A 4-12-4 has 20 units of plant food. The ratio is 1-3-1. A 5-15-5 has the same 1-3-1 ratio but contains 25 units of plant food. A 4-12-4 priced at $40 per ton costs $2 per unit. A 5-15-5 costing $47.50 is more expensive per ton, but the cost per unit is a trifle less, $1.90 per unit.

Misleading Comparison

A similar comparison of a 10-6-4 with a 4-12-4 would be misleading. Both have the same number of units (20 in each case). The ratios are 5-3-2 and 1-3-1 respectively. The 10-6-4 would be more expensive per ton and per unit because of its higher content of nitrogen which is the most expensive ingredient in mixed fertilizer. When used before seeding to grass, and applied at the same rate per acre in a soil with a very low content of available phosphorus the 4-12-4 fertilizer would be the best choice. On a soil with plenty of phosphorus, but deficient in nitrogen, the 10-6-4 would be preferable. Choice based on comparative cost per unit would be beside the point.

Two fertilizers of the same grade may vary in value, in price per ton, and in cost per unit. A 5-10-5 supplemented with trace elements costs more than one without them. The additional expense is justified when trace elements are needed to eliminate a soil deficiency.

A 10-6-4 with 5 units of organic nitrogen from a high quality vegetable meal or tank-

age costs more than one of the same analysis with all the nitrogen from sulfate of ammonia. Water insoluble organic nitrogen is higher priced than water soluble forms derived from inorganic sources.

A price comparison between a natural organic and an inorganic nitrogen fertilizer is always in favor of the inorganic. Both have their place in the turf fertilizer program. Comparisons based on cost per unit should be confined to members within each class; namely cotton seed meal vs. Milorganite, sulfate of ammonia vs. ammonium nitrate, etc.

Some state laws require manufacturers to state on the guarantee whether the fertilizer is acid or non-acid forming. Potential acidity of a fertilizer is expressed as the amount of lime required to neutralize its acid producing components. This is called the calcium carbonate equivalent. Many fertilizer manufacturers make neutral fertilizers by adding enough dolomitic limestone to the mixture to neutralize the potential acidity.

Fertilizer Mechanical Condition

The mechanical condition of a fertilizer is important. It should not become lumpy or harden during storage. Manufacturers of mixed fertilizer usually add a little cyanamid, and some good quality organic conditioner to the mixture. The use of well cured superphosphate is another aid. The problem of keeping sulfate of ammonia granular has been solved by neutralizing and pan drying it. The ordinary commercial grade of sulfate becomes hard as a rock in a short time. This can be prevented by mixing 1 part vegetable meal or Milorganite to 3 or 4 parts sulfate. Then it will stay granular indefinitely.

Bent Fertilizer Program

The fertilizer program for greens of bent grass must furnish enough of all the nutrients needed by the grass. The amounts of the major plant food elements removed in the clippings should serve as a rough guide. This information was given in last month's GOLFDOM.

After furnishing ample phosphoric acid and potash the problem is one of providing the correct amount of nitrogen. It is the growth promoting element. Enough should be used to develop a dense weed- and clover-free turf of desirable texture for play.

Excessive amounts which make the turf coarse and the grass soft and lush should be avoided at all times but especially immediately before and during hot wet weather. The tendency at some courses has been to be too frugal with nitrogen especially where topdressing has been reduced sharply in amount and frequency. This has favored clover and aggravated dollar spot because susceptibility to this disease is caused by too little as well as too much nitrogen.

When the topdressing does not contain manure compost need for nitrogen is accentuated and the possible necessity for more potash cannot be ignored. Clover will not increase provided the grass receives square meals of nitrogen. In the days when manure compost was used generously in the topdressing greens got more potash than now. Clover was not too hard to control. It was then and is now a matter of keeping a mat of dense tight turf.

The fertilizer program can be built around commercial mixed fertilizer, supplemented with nitrogen as needed; or phosphate and potash can be applied in spring and fall and nitrogen used as needed. Either way will give good results.

A program which furnishes during the season in the topdressing and fertilizer 5 to 6 pounds phosphoric acid, and 8 to 10 pounds potash per 1000 square feet provides double the quantity removed in the clippings. These amounts are more than enough to feed the grass, and offset losses from fixation or leaching on soils which have a satisfactory level of both elements when the program starts. The above quantities of plant food are contained in 25 to 30 pounds of 20 percent grade superphosphate, and 13 to 17 pounds of 60 percent grade muriate of potash. A half bag or 50 pounds of 0-10-20 contains 5 pounds of phosphoric acid and 10 pounds potash.

Bent Green Nitrogen Feeding

Bent greens should get from 1 to 1¼ pounds of nitrogen per 1000 sq. ft. per month. This is equivalent to 5-6 pounds sulfate of ammonia, or 18 to 20 pounds of cotton seed meal or Milorganite. In the Northern belt where dollar spot is the principal disease the nitrogen should be applied in approximately equal doses throughout the season.

Organics such as cotton seed meal or Milorganite can be applied once a month at about 20 pounds, sulfate of ammonia at about 5 pounds. When mixed fertilizer is used in addition, the rates for the nitrogenous fertilizer should be reduced so the total amount applied from both sources is not over 1 to 1¼ pounds per month. The organics can be applied in one application but the sulfate should be applied in two or three doses spaced 10 to 15 days apart at 1½ to 2½ pounds per 1000 square feet each time. Farther south where brown patch is prevalent in midsummer, spring and fall rates for nitrogen should be increased and midsummer rates reduced accordingly.

For those who prefer commercial mixtures the old 10-6-4, 8-6-4, 8-6-2, etc., grades are still satisfactory on greens

which are topdressed fairly frequent. A 5-10-5 or 4-12-4 can be used provided they are supplemented with nitrogen as needed. A 1-1-1 ratio, such as 8-8-8 or possibly a 2-1-2 ratio would be better on greens that are not topdressed more than once or twice a year with a mixture devoid of manure compost.

Another satisfactory plan is to use straight superphosphate and muriate of potash in spring and fall at rates which provide about 3 pounds phosphoric acid and 5 pounds potash each time or to apply an 0-10-20 or 0-20-20 at 30 pounds per 1000 in early spring and 20 pounds in August or early September. Then to use nitrogen as needed, applying cotton seed meal or Milorganite alone or in combination with sulfate, urea or ammonium nitrate. The organics are desirable to supply longer lasting nitrogen.

Application of Soluble Fertilizers

Soluble fertilizers, either as fertilizer material or as a commercial mixture may scorch the grass. They should be watered-in promptly to prevent discoloration of the grass, and should not be applied when there is dew on the turf, or when soil is so wet that moisture shows in foot prints. Too heavy rates will burn despite watering. Scorching is most likely in hot weather, and when the grass is succulent.

The use of lime on fairways and greens was discussed fully in 1946 issues of GOLFDOM. Those desiring detailed information should consult these articles. A summary of the present status of lime usage on bent grass greens is all that is justified here.

Aside from any direct adverse effect on growth, too much acidity weakens the grass plant, and restricts the root system. The grass is less able to withstand drought or cope with hot humid weather. It is more liable to injury from disease and chemical treatments.

The use of lime is justified on bent grass greens when soil reaction is below pH 6.0. A finely ground limestone is the safest and easiest form to use. One of high magnesium content, called a dolomite, should be used when a soil test shows low available magnesium (500 pounds or less, by the Hellige Truog Method). Suggested rates are as follows, for finely ground limestone:

RATES FOR APPLYING FINELY GROUND LIMESTONE TO GREENS

Soil Reaction	Limestone Rates Pounds per 1000 Sq. Ft.
6.6 to 7.0 pH	0
6.1 to 6.5	0-10 pounds
5.6 to 6.0	10-20 "
5.1 to 5.5	20-40 "
4.6 to 5.0	40-60 "
4.0 to 4.5	60-80 "

Care In Applying Lime

Ground limestone can be used at any time but is applied generally in early spring or during the fall. Hydrated lime must not be applied at more than 20 pounds per 1000 square feet at any time and in hot weather more than 2 to 5 pounds per 1000 sq. ft. may scorch the grass.

Lime, especially hydrate, must not be used immediately before or right after an application of fertilizer containing nitrogen in the form of ammonia. Bad burning of the turf will result and loss of nitrogen may occur.

The soil on a new green should be tested for reaction before seeding or planting stolons. Ground limestone should be applied at rates recommended above and worked into the soil. The application should be made as long as possible before seeding or planting.

A light application of hydrated lime, 2 to 5 pounds per 1000 square feet, is justified when a green becomes scalded during hot wet weather. The hydrate is used to kill algae and to counteract toxic organic compounds produced in water-logged soil. The application is made irrespective of soil reaction. Hydrate must be used because of its greater solubility rather than ground limestone. When the bad spell of weather persists for several weeks, turf responds to weekly doses of hydrate at not to exceed 2 pounds per 1000 square feet. It can be mixed with sand for bulk and broadcast over the green, or it can be applied with a power sprayer using a minimum amount of water.

PGA 1948 CHAMPIONSHIP TO ST. LOUIS

Bid of Fred Dowd for PGA 1948 championship at St. Louis has been accepted by pro association executive committee. Date and site as yet are not officially announced but probability is that the event will be played at Norwood Hills CC, Normandy, Mo., a northwestern suburb. Official announcement of the championship deal being completed was made in passing up a belated bid by Columbus, O. for the 1948 PGA event. Columbus was promised consideration for the 1949 PGA championship.

Whether or not Ryder Cup matches will be played in the U. S. this winter remains to be decided. It will cost more than $20,000 to bring the British team over. Fall