THE ROLE OF NON-NITROGEN FERTILISER ELEMENTS

by

DR. MARVIN H. FERGUSON, speaking to the International Turf Grass Conference organised by the Golf Course Superintendents Association at Philadelphia earlier this year. Dr. Ferguson, Mid Continent Director of the U.S.G.A. Green Section, discusses five major elements present in fertilisers to which response is less immediate than to nitrogen but which are all used by grass in considerable quantities.

Fertiliser recommendations for turf are often made in terms of pounds of nitrogen per unit of area. This is done because nitrogen is used in greater quantities than are the other materials, because of the relatively great response that occurs following its use and because it is the element most likely to be in short supply.

While such thinking may be valid from a practical viewpoint, it creates the danger of minimising in our consciousness the importance of the other elements, some of which are used in substantial amounts. These major elements are phosphorus, potassium, calcium, magnesium and sulphur.

Studies of plant tissues have indicated that nitrogen, phosphorus (expressed as P_2O_5) and potassium (expressed as K_2O) are present in the turf plant in the approximate ratio of 3-1-2. Thus the fertiliser grades commonly sold for turf use are 10-3-7, 12-4-8, 12-6-6, 10-5-5, and similar grades. Usually recommendationes for the use of phosphorus and potassium are made only in terms of such ratios.

Calcium and magnesium are rarely recommended as plant nutrients. They normally are recommended as correctives for soil acidity. The quantity necessary for such purposes is ordinarily more than is necessary for nutrient use.

Sulphur is rarely recommended as a plant nutrient. In areas where conditions of alkalinity or salinity occur, sulphur is sometimes recommended, particularly in the form of gypsum. Sulphur occurs widely enough in fertiliser materials that it is seldom in short supply. It seems likely, however, that the trend towards higher analyses and greater purity of fertiliser materials may result in more frequent shortages of sulphur in the soil.

It may be profitable to examine each of these major nutrients in some detail and to refresh our thinking with respect to the role that each element plays.

Phosphorus

Phosphorus is chiefly derived from phosphate rock. Phosphate rock is treated with sulphuric acid to produce superphosphate which is one of the most common of the phosphorus bearing fertiliser materials.

In recent years phosphoric acid has gained more prominence in fertiliser technology. The ammoniation of phosphoric acid provides ammonium phosphate. This is a high analysis material that sometimes is sold directly but which more often goes into mixed goods.

While phosphorus performs numerous important roles in plant growth, it is not used by the plant in large amounts. It has been reported that phosphorus comprises from 0.2% to 0.8% of the dry matter of plants. Plants in a nutrient solution have grown to maturity with no noticeable deficiency symptoms when the concentration was as low as one part per million.

One of the reasons we supply phosphorus in relatively large amounts as a fertiliser is because of the fact that it becomes tied up quickly in the soil. Phosphorus reacts with such cations as calcium, magnesium, and iron to form relatively insoluble compounds. Plants can obtain some phosphorus from such compounds but their ability to do so varies with species. Rapidly growing plants may therefore obtain too little for their needs. This fact assumes greater importance when we consider that phosphorus occurs in its greatest concentrations in the plant in those parts that are growing most rapidly. Therefore we continue to supply fertiliser phosphorus in forms readily available to the plant even though the total phosphorus content of the soil may be quite high.

In its physiological role in the plant phosphorus is one of the components of numerous compounds. Among them are phytin, phospholipides, nucleic acid, and phosphoproteins. Phosphorus also enters into the processes of reduction of other compounds and of respiration.

Much has been said about the use of phosphorus for the promotion of root growth. In some of the early research, it was found that root crops such as beets, turnips and mangels responded to high amounts of phosphorus. Later it was found that heavy phosphorus applications resulted in a higher proportion of roots to tops in several species. However, under conditions where all the nutrient elements are in adequate supply, there is little evidence to support the belief that additional phosphorus will promote the growth of roots.

Potash

The element potassium usually is supplied in the form of potassium chloride (muriate of potash) or as potassium sulphate. Potash salts are mined in the southwest part of the United States. Only physical processing is required to prepare them for market. In recent years a relatively small amount of potassium nitrate and potassium phosphate has been marketed.

Most fertiliser potash for turf has been used as a part of a complete fertiliser grade. However, some users prefer to apply it separately. On putting greens it is sometimes used in spring and in fall and left out of the fertiliser programme during the summer months.

Potassium salts such as potassium chloride, potassium sulphate, potassium nitrate, and potassium phosphate are quite soluble. Thus potash in this form will leach quite rapidly in a sandy soil. However, with heavier soils which have a high exchange capacity, potassium ions may become fixed on the clay micelles. The clay will then provide potassium ions to the growing plant in a more or less constant supply.

It is difficult to know how much potash a plant requires. Students of mineral nutrition have been unable to find evidence that potassium enters into the plant structure or into any permanent organic compound in any way. It has often been described as a buffering agent in the plant's sap. Because potassium is taken up by the plant beyond its need, the plant content is not a reliable indicator of the amount required. Therefore an analysis of potassium in the plant may be misleading. Experiments with zoysia have shown that approximately 7 m.e. of K per 100 grams of dry matter will produce as

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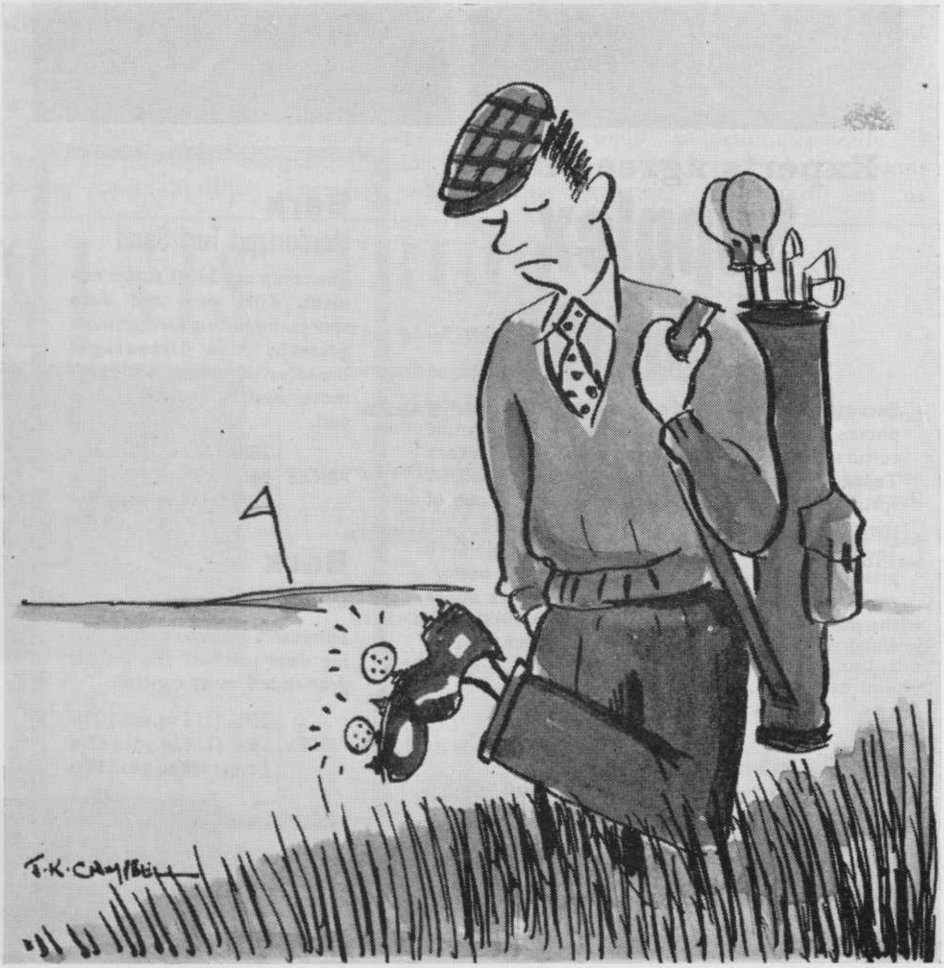

much growth as will 40 m.e. per 100 grams.

We have said that despite a great deal of research the exact role of potassium is obscure. It is reported that potassium affects synthesis of carbohydrates, translocation of carbohydrates, reduction of nitrates and synthesis of proteins, and normal cell division. It is also suggested that potassium has a role in maintaining turgor and that it may contribute to disease resistance.

Experienced superintendents have noted that there is a danger of getting too much available potassium on turf. On putting greens an excess of potassium will sometimes cause grass blades to become stiff and harsh to the touch.

To be concluded in July.

(With grateful acknowledgments to "The Golf Course Reporter")

'Greenfields', Howard Crescent,
Seergreen, Nr. Beaconsfield,
Bucks.

Yesterday afternoon the Green Committee played against my staff, then entertained us in the club after the match to a good "Nosh Up" and a few pints. This is the first match of what will become an annual event. I should think it happens in all clubs, I wonder if any others do it? The result was a win for the greenkeepers, but then we should know the greens better!

Sincerely yours,
R. H. PLAIN.

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