GRANULAR AND FOLIAR FERTILISERS IN TURFGRASS MANAGEMENT

By Tim Butler

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Golf course greens are an extreme example of a stressed setting. It is important to remember that about 75 per cent of shots are made on the green, yet a green takes up about two per cent of the landmass of a golf course (Rogers, 2006, Pers., Comm.).

On a green, the grass blade is severely reduced by regular mowing. In addition, when the blades are cut and removed, the ability to recycle the valuable minerals contained therein is eliminated. Thus understanding the nutritional requirements of turfgrass is among the most important factors in their successful culture. Correct nutrition is essential for the plant to carry out physiological processes and for maintaining high quality.

The aim of fertiliser application, along with other maintenance practices, is to produce an adequately dense and vigorous turf, which is tolerant to wear, withstands adverse weather conditions, is not prone to diseases, contains few weeds and is aesthetically pleasing.

For highly maintained turfgrass areas, there is an ever-growing selection of products available in both granular and liquid forms and it is easy to become over-loaded with information regarding the various formulations. In the past, granular fertilisers were the main option available to greenkeepers and course managers, as limited liquid formulations were available.

GRANULAR FERTILISERS

Solid fertilisers are dry particles that generally range in size from 0.85 to 4.75mm. The fertiliser material may be crushed, granular, prilled or crystalline and usually, to ensure uniformity, the largest-sized particles are not greater than four times the sieve size in processing that holds about 90 per cent of the product (Crum, 2006, Pers., Comm.).

The granular size is usually quantified using the size guide number (SGN). Generally a SGN under 100 is used on greens, and a size guide number between 125 and 150 on fairways.

Granular fertilisers can be homogenous or non-homogenous. A blended fertiliser, containing mechanically mixed fertiliser products, is an example of non-homogenous. Such products could include a fertiliser that had, for instance, a nitrogen source mechanically mixed with phosphorus and potassium sources to give a complete fertiliser. Such fertilisers often have different colour prills, which vary in size, and problems with segregation of the various prill sizes can occur. When different nutrient sources are combined to give a single granular prill containing all of the nutrients, then a granular homogenous product is produced.

Several forms of granular fertilisers exist, including cold water-soluble, hot water-soluble, and coated materials. Common examples of water-soluble fertilisers include ammonium sulphate, ammonium nitrate and urea. Such liquid fertilisers should not be confused with true foliar fertilisers, which are chelated with amino acids (Vargas, 2006. Pers., Comm.).

Water-soluble fertilisers are very commonly used in turfgrass nutrition. The 'little and often' policy is often used with these sources, since the nutrient content will only last a short length of time. Probably one of the main problems with these fertiliser types is their leaching potential, particularly under heavy rainfall. Slower release products include IBDU, sulphur-coated ureas, polyon and polys products. These products have gained momentum in their use, and many golf course managers use such products particularly during spring and early autumn as a means of ensuring a constant controlled supply of nutrients to the sward. Quick release or foliar products at low rates frequently complement these products.

FOLIAR FERTILISERS

Although turf managers have been practising foliar feeding for some years, there has been a dramatic increase in foliar fertilisation on greens, tees and fairways in recent times, with many managers integrating foliar feeding with granular nutrient programmes. In foliar fertilisation, the fertiliser elements applied to turfgrass leaves are absorbed through tiny cracks or pores in the leaf surface in the wax layer. These pores are very small tubes, and are lined with water. They are called transcuticular pores.

Foliar fertiliser does not penetrate the stomates of leaves. The inner walls of the stomates (water control valves for leaf cooling) are covered with globs of wax, to repel outside water from entering the stomates themselves. Kopec (2001) reported that as the number of stomates increases so too may uptake of larger size chelates such as iron. This is due to the fact that more micro-pores are present between the stomates, as their numbers increase and permeability increases (Kopec, 2001).

Two primary forces regulate the movement of nutrient ions in solution; one is chemical and the other is electrical. Ions move down the chemical gradient from a higher to a lower concentration to reach equilibrium. Ions also tend to be transported most easily against an electrical gradient, when their electronegative potential is low.

Some turfgrass professionals feel that they have more control over their grass growth when using foliar fertilisation and the use of fertigation as a means of applying foliar fertiliser has gained publicity. Other potential benefits of foliar feeding include:

- Rapid greening
- Reduction in leaching potential
- Low cost per unit of nutrient
- Ability to spoon-feed the turf
- More-even grass growth
- Useful when plant is under stress, such as from heat

Probably the two main drawbacks to the use of foliar fertilisation are the cost of the specialized equipment needed and the amount of labour required. Unlike granular fertilisers, in particular slow-release products, foliar fertilisers need to be applied on a frequent basis, since applying large amounts of N, P, and K in a foliar feed will likely burn the foliage.

Common practice among managers when using foliar feeding is 'little and often', with rates as low as one-tenth of a pound of nitrogen being applied every couple of weeks in some situations.

RESEARCH

A lot of confusion currently exists regarding the amount and speed of foliar nutrient adsorption after application. Some turfgrass managers believe that they should irrigate the turf shortly after spraying the nutrients to prevent burning. However, the question remains: Are you actually washing off some of the applied nutrient that has not yet been absorbed? Work at Clemson University has shown that 55 per cent of 15N-urea applied was absorbed by tall fescue and Penncross creeping bentgrass.

Research into foliar absorption rates of macro- and micro-nutrients over time on both bentgrass and annual bluegrass swards is being carried out by Michigan State University, in conjunction with the University of Nebraska and Clemson University. I have been involved in this research under the direction of Professor Kevin Frank at Michigan State University. The study involves using products containing nitrogen sources including ammonical nitrogen, nitrate nitrogen and urea. It is being carried out over a prolonged period and so far shows that a high proportion of nutrients applied are absorbed within the first six hours. Further research will hopefully give a better indicator of exactly when the majority of applied nutrients are absorbed.

Many conflicting reports have been released on the topic of foliar versus granular fertilisation. Research carried out by Bigelow et al (2003) at Purdue University in a trial evaluating nutralene (slow-release fertiliser) versus urea applications showed on numerous occasions that the granular product gave better colour and quality compared to the urea. In this experiment nutralene was applied monthly at 0.5lbs N per 1000sq ft and urea was applied every 7-10 days at 0.125lbs N per 1000sq ft to a mature Pennlinks creeping bentgrass green. Liu et al (2006), in an experiment at Clemson University, reported better turf quality in a sward treated with foliar fertilisers compared to granular fertilisers, with the same N input for each.

In my opinion, foliar fertilisation is a very useful tool to turfgrass managers, particularly for applying iron, urea and ammonium nitrogen as well as magnesium and potassium. Foliar feeding will yield excellent turfgrass quality, however complete replacement of conventional fertiliser programmes (water-soluble and controlled-release products) with complete foliar programmes may be questionable.

It is true to say that the use of granular fertilisers, in particular quick-release products, can be wasteful, as shown by a report suggesting that foliar feeding urea accounted for 95 per cent of plant use compared to about 10 per cent plant use from applications to the soil. Complete removal of granular products from a management programme may reduce nutrient concentrations contained with the turfgrass rootzone dramatically over time and leave a very low reserve for the plant to use if needs be. Thus, at present, the use of foliar feeding with some strategic use of granular fertilisers appears to be best.

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Pictures: Courtesy of Professor Kevin Frank, Michigan State University

References

Bigelow, C., Hardebeck, G., and Walker, K. 2003. Creeping bentgrass putting green turf response to granular and foliar nitrogen programs. *www.agry.purdue.edu*

Gertal, B. 1998. Liquid vs granular fertilizers. Grounds Maintenance. August.

Kernan, M.J. 2003. Biofertilizers- a new tool for turf. *www.greenmediaonline.com*

Kopec, D.M. 2001. You get what you spray for foliar feeding - facts and fantasy. *http://ag.arizona.edu/turf/ccps101.htm*

Liu, H., McCarty, L.B., Baldwin, C., Totten, F., Long, S., and Thackston, J. 2006. Enhanced bermudagrass putting green turfquality by using a combination of foliar fertilization and plant growth regulator. Agronomy Society of America International Meeting. November 6-10, Indianapolis.

McCarty, L.B., Rodriquez, I.R., Bunnell, B.T., and Waltz, F.C. 2002. Fundamentals of Turfgrass and Agricultural Chemistry. John Wiley and Sons publishers, New Jersey. 375pp.

Middleton, W.D. 2001. Just what constitutes true foliar feeding. *www.turfgrasstrends.com*

Totten, W., and McCarty, B. 2004. Foliar feeding. Grounds Maintenance. April.

Turner, T.R., and Hummel, N.W. 1992. Nutritional Requirements and Fertilization. p. 385-439. In: Waddington, D.V., Carrow, R.N. and Shearman, R.C. (Eds.). Turfgrass. Agronomy Monograph No.32. American Society of Agronomy, Crop Science Society of America, Soil Science Society of America. Madison, Wisconsin.