# DEVELOPING A COMPLETE TURF FERTILITY PROGRAM

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Developing a fertility program is one of the most important and complex decisions a lawn care company will have to make. While it would be convenient to have a generic program that could be applied to all situations, there is no one program which will produce excellent turf under all conditions. Fertilizer needs vary according to existing soil nutrient levels, species and cultivars being grown, soil physical conditions, level of quality desired, and many other factors. Thus, rather than providing a "cookbook" recipe for success, it is more reasonable to discuss the components of a sound fertility program and then adapt those principles to a particular situation. The four main variables in any fertility program include: nutrient to be applied, frequency of application, rate of application, and timing during the season.

Of the 13 essential mineral elements necessary for growth; nitrogen (N), potassium (K), and phosphorous (P) are the principal nutrients applied in most fertility programs. Turfgrasses require N, P, and K in a ratio of approximately 4-1-2. Thus, when fertilizing established turf, it is a good idea to use a fertilizer which provides N, P, and K in roughly this ratio rather than a fertilizer which provides more P than K.

Nitrogen is the backbone of a fertility program and is applied in the greatest amount because of its many effects on turfgrass growth. Adequate nitrogen is needed to maintain: a dark green color, high shoot density, and the ability to recuperate from stress or pest injury. On the other hand, excessive N can: increase disease problems, reduce tolerance of high and low temperature, and result in moisture stress due to increased growth which exceeds available moisture. Thus, it is important to provide N at a frequency and rate which will assure vigorous growth without overstimulation.

A source of N can be chosen which is either quickly available to the plant [water soluble nitrogen (WSN)] or slowly available to the plant over a period of months or even years [water insoluble nitrogen (WIN)]. Both types of N have advantages and disadvantages.

WSN comprises the majority of N applied by most lawn care operators. Ammonium nitrate, ammonium sulfate, and urea are some of the types of WSN used, with urea being the most commonly used by far. WSN provides a rapid increase in both color and growth rate. It can be applied in either granular or liquid form and is less expensive than the WIN sources. Because the release of N from WSN sources is relatively independent of temperature, WSN can be used throughout the season with acceptable results. These attributes are the advantages associated with WSN.

Compared to WIN, some disadvantages of WSN include: high foliar burn potential when applied at excessive rates or during periods of high

temperature, relatively short period of plant response (six to eight weeks at normal rates), and greater potential for loss via leaching or volatility (gaseous losses).

Although the characteristics listed above have been described as either 'advantages' or 'disadvantages', you must decide how those characteristics affect your particular situation. For example, many lawn care operators do not consider a six to eight week residual response a disadvantage. They want the customer to notice a decline in color so that along with the next application the customer notices an improvement in color.

Another type of nitrogen which can be incorporated into a fertility program is water insoluble nitrogen (WIN), which releases its N slowly over a longer period of time than WSN. Because of their ability to meter out N slowly over a long period of time, slow release N sources have a low potential for foliar burn. They also provide a longer residual plant response than WSN and do not result in flushes of rapid growth. WIN is less reactive than WSN so that less is lost via leaching and volatilization.

Potential disadvantages associated with WIN include: slow color response, inability to use some sources in liquid delivery systems, high cost per unit of N, and potential carryover of N into the following growing season. This last aspect (carryover of N) is a problem unique to the lawn care industry where customer cancellations are a common occurence. One does not want to pay more for a product which will fertilize a customer's lawn for several months or years if the customer cancells early in the program.

Typical slow release N sources include: ureaformaldehyde products (UF), isobutylidene diurea (IBDU), sulfur coated urea (SCU), and products derived from natural organic materials such as activated sewage slude, seaweed, and other plant and animal residues. All of these WIN sources can provide good results when properly used. However, UF products and SCU sources are most widely used in the lawn care industry.

Ureaformaldehyde (UF) fertilizers depend upon microbial activity to release N from complex organic polymers (long chain compounds). Thus, factors which favor microbial activity will also favor N release. Soil temperatures > 55 F, adequate moisture, adequate aeration, and a pH between 6.0 and 7.0 will allow UF products to work properly.

Sulfur Coated Urea (SCU) releases N slowly because the urea pellet (prill) is covered with a coating of sulfur and ,sometimes, plastic. Thus, N leaks through the pores at a slow rate compared to uncoated urea. Prills which have an incomplete or cracked coating will behave like WSN. Thinnly coated prills will release N more rapidly than thickly coated prills. Adequate moisture and warm soil temperatures (> 55 F) are factors favoring release of N from SCU.

Because both WSN and WIN have desirable attributes, it is often a good idea to use a fertilizer which contains some of each type. Indeed, many commercially available fertilizers contain both WSN and WIN. The

ratio of each in the product will vary according to release rate desired, price, and other factors. A material containing approximately 20 to 25 % of the N as WIN can provide some of the advantages of WSN (quick greenup, release independent of temperature, and lower cost than WIN ) while incorporating some advantages of WIN ( lower burn potential, less leaching, and less frequent application than WSN).

Once a N fertilizer has been chosen, one must decide at what rate to apply the product. Fertilization rate depends upon many factors such as: N source to be applied, time of the year, and fertility requirement of the species and cultivars present. When using solely WSN, application rates of 1 to 1.5 lbs. N per 1000 $ft^2$ are recommended in order to avoid undesirable growth surges and potential foliar burn. If the fertilizer contains some WSN, the application rate may approach the 1.5 lb. limit. Fertilization during July and August should be approached cautiously in order to avoid excess growth during periods of high temperature and moisture stress. The proportion of WIN in a fertilizer is often increased during the summer to protect against foliar burn. A typical fertilization program results in the application of about 3.5 to 5 lbs. N per 1000 $ft^2$ per season. Keep in mind that the main objective is to produce acceptable quality turf. If the customer is satisfied and the turf is healthy at a rate lower than 5 lbs. N per 1000 $ft^2$ per season, reducing the rate is justified.

Programs utilizing only WSN will require more frequent applications to maintain acceptable turf than a program which incorporates some WIN. In general, most lawn care programs make four to five applications to a lawn per season with three or four of those applications containing N fertilizer. The timing of those fertilizer applications during the season is an important consideration.

In the northern U.S., many agronomists consider the late August/early September fertilization to be the most important. Recovery from summer stress injury as well as increased tillering and rhizome production occur during the fall. Thus, N must be provided in order to maximize these processes. An N application during late spring is also widely practiced in order to enhance color going into summer and to encourage growth before the high temperatures and moisture stress of summer occur. It is important that this application does not stimulate the turf to rapid growth during the stressful summer months (especially if irrigation is not available).

When a third fertilization is practiced, a late season application is often chosen. This application should be made when the turf has stopped growing ( several weeks after the last mowing ) but before it has lost its green color. An application at this time will enhance winter color and can provide earlier spring greenup ( three to four weeks) than programs without a late season application. This concept has also been shown to improve Kentucky bluegrass rooting during spring. Results on bentgrass and fine fescue will likely differ from those on Kentucky bluegrass. While late season fertilization is increasing in popularity, it is a concept which must be well understood in order to produce optimum results. Thus, consult with your state turf specialist before embarking on a late season program.

Finally, many programs also employ an early spring application of N. This application is used primarily to enhance greenup at the time when preemergent weed materials are being applied. If a late season application is used, the N rate during early spring can be reduced substantially since color will be markedly enhanced from the late season application. Also, many lawn care operators are applying iron during early spring to enhance color without forcing excesive growth.

While N is the main component of all fertility programs, several other elements also bear mention. Potassium (K) is needed by turf in amounts second only to N. Adequate K fertility improves wear tolerance, heat and cold tolerance, stolon and rhizome growth, and rooting (thus improving water uptake). While every fertility application may not include K, those applications preceeding stress periods are good times to supplement K. The eary fall application in particular is often made with a fertilizer containing K and N in a 1:1 ratio to improve winter survival without overstimulating growth. K should be applied on the basis of a soil test.

Phosphorus (P) is helpful in improving both the rooting and winter hardiness of turf. In particular, it is essential when establishing new seedings of turf. Adequate P in the seedbed helps to insure rapid establishment. On mature turf, P is rarely found to be deficient. Thus, there is little value to applying P unless a soil test shows it to be deficient. P is strongly bound to the soil and will not easily move downward, therefore, it is a good idea to apply P in conjunction with some process which will facilitate its incorporation into the soil (aeration, vertical mowing, etc.).

Another element which can be incorporated into a fertility program is iron (Fe). Iron functions in chlorophyll synthesis and thus is used to provide a rapid increase in green color when the growth stimulation associated with N is undesirable. Early spring or summer applications of Fe are becoming increasingly popular.

Iron is very strongly adsorbed to the soil and thus is often unavailable to the plant for use. In order to increase plant availability, iron is applied as a liquid rather than as a granular product. Also, "chelated" iron is often chosen as a source of Fe. A chelating agent is a soluble organic compound that binds with Fe to make it more available to the plant. Intelligent use of Fe can result in a healthier plant and reduced need for N.

In conclusion, there are many factors which must be taken into consideration when formulating a fertility program. A basic knowledge of plant nutrition, fertilizers, and soils as well as a willingness to experiment with your current programs are keys to finding the program best suited to your situation.