"Degree-Day and IPM"

**Dr. Joe Russo and Dennis Watkins*

This issue is dedicated to Integrated Pest Management or IPM. The success of most IPM programs depends, in part, on the availability of timely, accurate information on the development and interaction of a pest with its host crop. There are many variables defining the information needs of IPM, but most popular is the concept of "degree-day." The degree-day is derived from temperature observations. Dating back to the 18th century, it is probably the oldest variable used to track the development of pests and crops. Today, the degree-day is in many forms, such as growing degree-days, and heat-units.

When degree-days are summed or "accumulated" over time, they are a measure of the thermal requirements of an organism in order to reach successive "phenological" or life stages. Since the amount of heat varies from day-to-day, accumulated degree-days provide a more accurate unit than summed calendar days to account for the impact of weather on an organism's development and growth. In its simplest "arithmetic" form, a degree-day is calculated by subtracting an average daily temperature from an organism-specific base value. It is then accumulated daily over the organism's lifetime. For most crops, the base is 50 °F. For most insects, bases range from 40 to 55 °F. Other computational forms can be used to calculate daily and accumulated degree-days, such as the "sine-wave," which is also known as the "Allen" method. These more sophisticated forms usually employ an upper limit, which accounts for the fact that an organism's growth is retarded when the environment becomes too warm. A typical upper limit for many agricultural pests is 95 °F.

From the perspective of the sports field manager, degree-days play an important role in turf IPM. By watching the changes in the degree-day-driven phenologies, a manager can identify the best "window" for controlling a pest or amending turfgrass. Diseases such as anthracnose, gray leaf spot (ryegrass), and summer patch can be specifically monitored by degree-day accumulations. Degree-days can be used to track crabgrass emergence and its seasonal development. They can help a manager focus applications for both pre and post weed control at the most favorable dates. The timing of weed and other pest controls can vary as much as three weeks from season to season.

The degree-day approach in decision-making removes much of the guesswork that can result in poor control and put a manager's job in jeopardy. The degree-day approach quantifies the timing of turf and pest events and provides a temporal framework for IPM practices. The use of degree-day-based IPM is some of the best evidence to an employer, the public, and regulatory agencies, that an individual has taken an informed, professional approach to sports field management. ▲

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"Rutgers Corner"

"Park's Department"

Brad Park is the Sports Turf Research and Education Coordinator at Rutgers, The State University of New Jersey. He is assisting sports turf managers of NJ through education and research to help provide better sports turf for the citizens of NJ. .Ask Brad Park your questions: E-mail us at hq@sfmanj.org

Question: *When selecting a single Kentucky bluegrass variety or blend of different varieties to be included in a seed mixture for an athletic field renovation, what are the major considerations in selection and how would you prioritize those considerations, if at all?*

Answer: There are a number of different factors involved when choosing a Kentucky bluegrass or a blend of Kentucky bluegrasses for an athletic field. For sports turf areas that receive high levels of use, maintaining adequate turfgrass cover is a high priority. The ability of bluegrasses to resist and recover from traffic stresses should be the most significant consideration in selecting a variety or varieties.

The Center for Turfgrass Science at Rutgers University is leading the way to help enable sports turf managers to make these decisions by utilizing its National Turfgrass Evaluation Program (NTEP) Kentucky bluegrass trial to examine the traffic tolerance of Kentucky bluegrass selections and varieties.

A turf manager faced with the selection of varieties should use data provided by NTEP to assist in the decision. Annually, NTEP provides reports on the evaluation of turfgrass species such as tall fescue, perennial ryegrass, and Kentucky bluegrass. Varieties of each species are evaluated at different locations across the country for turfgrass color, density, texture, disease susceptibility, and quality as well as several other parameters. The results are available at www.ntep.org

Additionally, Rutgers Cooperative Extension provides fact sheet recommendations on the varieties best adapted to New Jersey at www.rce.rutgers.edu/pubs

As a method to evaluate the traffic tolerance of Kentucky bluegrass varieties and selections, the Center for Turfgrass Science at Rutgers utilizes a roller to create compaction stress and a machine to simulate wear. Turfgrass quality is assessed for these Kentucky bluegrasses and indicates the overall appearance of the turf. Turf quality incorporates several components including: density, cover, leaf texture (measure of the leaf width), uniformity, and freedom from insect and disease damage. Quality is assessed on a scale of 1-9 where 9=highest quality.

An analysis of non-traffic quality data from the Rutgers' North Brunswick Hort. Farm II location showed the following four commercially available Kentucky bluegrass varieties to have the highest mean turfgrass quality in 2002: Princeton 105 (7.1), Award (6.4), Blackstone (6.3), and Serene (6.3).

When traffic (wear and compaction) was applied to all varieties, the following commercially available Kentucky bluegrass varieties were the top performers for turfgrass quality in 2002: Princeton 105 (7.3), Tsunami (6.9), Midnight II (6.7), Award (6.7), Nu Destiny (6.5), Awesome (6.3), Odyssey (6.2), Total Eclipse (6.2), Barrister (6.2), Ginney (6.2), Cabernet (6.1), Impact (6.1), and Moon Shadow (6.1).

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Note that Blackstone and Serene were not on the list of top performing commercially available varieties when assessed for quality when traffic was applied to the plots. When traffic was applied to these varieties in 2002, mean turfgrass quality for Serene and Blackstone showed statistically lower ratings compared to the top performing varieties.

While this data represents only one year of research data at Rutgers, Princeton 105 and Award showed excellent turfgrass quality with and without the application of traffic. Research in 2003 will determine whether these varieties continue to tolerate traffic.

Whenever possible, a sports turf manager faced with the decision of choosing a Kentucky bluegrass for his or her field should examine traffic tolerance data as part of the decision-making process as some varieties may provide outstanding turfgrass quality when grown under optimal conditions, but perform moderately or poorly when compaction and wear become part of the equation. ▲

"Monthly Field Tip"

**By Jim Hermann, CSFM*

Here is a *formula* that I came up with that will answer every question concerning fertilizer. All you have to do is plug in the known factors to calculate the unknown. Try it!!

Formula: $100 \div \%N \times (R \times A) = Q$

%N = % nutrient or % active ingredient based on analysis

R = Rate of Application (1 lb. N per th. sq. ft., 1lb. active ingredient per acre etc.

A = Area

Q = Quantity (lbs. tons, of product)

T = Total nutrient or total active ingredient based on quantity

T = (R x A) (when T is the unknown or known factor, T can replace (R x A) in the equation

Examples:

Question: If you have 600 lbs. of 20 –10-10 fertilizer in your shed how much area can you fertilize at 1 lb. N/ th. ?

Formula: $100 \div \%N \times (R \times A) = Q$

$$100 \div 20 \times 1\text{lb.}/1000\ \text{ft}^2 \times A = 600$$
$$5 \times 1 \times A = 600$$
$$5A = 600$$
$$A = 120{,}000\ \text{sq. ft.}$$

Question: How many lbs. of 40-0-0 does it take to fertilize a soccer field 360'x210'? @ 1.5 lb. N per 1000 ft.^2**?**

Formula: $100 \div \%N \times (R \times A) = Q$

$$100 \div 40 \times 1.5 \times 75.6\ \text{th.sq.ft.} = Q$$
$$2.5 \times 1.5 \times 75.6 = Q$$
$$283.5 = Q$$

Question: How many lbs. of 20-5-10 fertilizer is necessary to provide 1 lb. N per/ 1000 sq. ft.

Formula: $100 \div \%N \times (R \times A) = Q$

$$100 \div 20 \times 1 \times 1 = Q$$
$$5\text{lbs.} = Q$$

Question: How many pounds of fertilizer does it take to fertilize 500,000 sq. ft with 31-0-0 at 1.5 lbs. N/1000 sq.ft.

Formula: $100 \div \%N \times (R \times A) = Q$

$$100 \div 31 \times 1.5 \times 500 = Q$$
$$2419.35\ \text{lbs.} = Q$$

If you have a tip or shortcut that you would like to share with your fellow sports field managers write or call us at SFMANJ or email at hq@sfmanj.org ▲

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"Field Marking Paints:

Characteristics and Composition

**by Mark A. Whitlam*

Field Marking has come a long way from the days of lime, chalks and oil based paints used to mark the lines on sports fields. Today, painting with latex based field paints has become the choice method for lining and decorating fields. The use of latex paints has a distinct advantage over its predecessors, being safe for the environment, non-damaging to the turf, having relatively low cost per application, and being easy to clean up.

Today's field marking paints are derived from a mixture of a vehicle, the liquid portion of the paint, and pigments, the solid portion of the paint. Within each of these segments, the paint derives its own characteristics. In field marking paints the vehicle contains three primary ingredients—Included in the vehicle is the solvent (water), the binder (latex resin), and wetting or dispersing agents (the same liquids used in dish soap). The pigments include Titanium Dioxide (the whitest pigment available) used as a primary pigment and filler pigments such as Calcium Carbonates, Silicates, Talc, and Kaolin (clay). All of these materials are combined and ground to form a coating desirable for the decoration or identification of the boundaries.

Latex has become the binder most used in field marking paints due to its unique structure and ability to be reduced with water. Once latex has dried, it forms a complex polymer structure of lattices (hence latex) much like lattice work in construction. However, these lattices build layer upon layer in all directions to produce a paint film. This allows the substrate, in this case the grass, the ability to "breathe". More descriptive, the distance within these lattices allows for oxygen and carbon dioxide interaction. This structure also allows for evaporation of very small water molecules leaving the blade of grass, fueling the grass for continued growth.

Pigments give the paint its color and are generally organic in nature when it comes to field marking paints. Nontoxic organic pigments have been used since man first began drawing on cave walls over 15,000 years ago. Organic pigments or pigment colors, however, have changed significantly in the past 100 years. Only recently have organic pigments been utilized as much as they are today. One reason for the lack of use for organics was its relatively high cost compared with leaded pigments. Today, organic pigments can now be synthetically manufactured, offering the user stronger tint strengths, better lightfastness (ability to keep its color), and in a few cases, new pigment types or color shades allowing for a larger range of colors. With these recent advancements, organics have offered increased value in their use.

Lead based pigments are still used in some field and marking paints even today. You should avoid using lead based pigments in any type of paint due to its toxicity and its ability to be absorbed through the skin. Leaded pigments used in turf paints can also leach from the grass causing ground contamination. Leaded pigments are commonly found in traffic yellows using chrome yellow pigments, greens using chrome green or chromium oxide pigments, reds using red lead, and oranges using chrome orange pigments or "moly orange" (molybdate orange). Be sure to review the material safety data sheets to see whether the paints you are using contain any of these products.

Titanium Dioxide is the choice pigment when it comes to white paints. Titanium Dioxide has the greatest hiding ability and also has the highest level of brightness than any pigment known. Titanium Dioxide is used in everything from plastics to toothpaste. How do you think your teeth get so white? Titanium Dioxide is rarely ever used as the single pigment in a paint coating due to its high cost and very small particle size. Filler pigments are used to reduce the cost and fill in the gaps between the Titanium particles. The use of filler or more commonly known, extender pigments, gives the paint better hiding ability and better reflectance. For example, if you had a jar half full of large marbles (filler or extender pigments) and added smaller marbles (Titanium Dioxide pigments) and mixed them together, the smaller marbles, when properly dispersed, would fill in the gaps to produce tighter grouping – allowing very little light to pass through.

In field marking paints, it is desirable to use larger particle-sized extender pigments in combination with Titanium Dioxide to produce better reflectance and light scatter. This gives the paint coating a flat appearance and allows the light reflecting off the surface to scatter in all directions.

If you were to look at a flat coating under an electron microscope, it would give you and impression of looking down at the snow-covered mountains with its many peaks and valleys. These extender pigments or larger particle sizes form peaks and the smaller Titanium Dioxide particles fill in the valleys, giving the paint its reflectance value and hiding ability. This type of hiding is desirable for both low angle viewing and optimum reflectance under artificial lighting.

Surfactants or "wetting agents" and dispersants are the smallest part of field marking paints. Typically, only 1-2% of the total paint consists of these agents. Surfactants and dispersing agents get their name from how they perform. Surfactants are "surface active agents." Most dry pigments are "hydrophobic" in nature, meaning they fear water. Therefore, these surfactants allow the latex and water to combine with the pigments and stay "wet" in solution. Depending on its nature, surfactants will also aid in the wetting of the substrate or grass. The dispersing agents keep all the ingredients mentioned above in solution and prevent settling out. ▲

**Whitlam Paint Company - www.whitlampaint.com/paintcharacter.cfm*
Read more about paints on their website.