tant tool for improving plant health and should be used as often as possible.

DEEP DRILLING/DRILL-AND-FILL

Deep drill and drill-and-fill machines use a series of drill bits arranged in a grid to penetrate the soil to a depth of 10-12 inches. In many cases, this equipment allows turf managers to penetrate compacted layers that might exist deeper in the profile to improve subsurface drainage. Drill-and-fill machines have the added benefit of allowing turfgrass managers the option of filling the holes back with a soil amendment of their choice. In poorly drained soils and soils that with abrupt changes in soil texture within the profile it is common to fill the holes back with a coarse sand to improve infiltration rates. The primary disadvantage of these systems, if it is to be considered one, is that they are very slow taking 12 or more hours to cover an acre.

HIGH PRESSURE WATER INJECTION

These systems use high-pressure water that is directed through small-diameter nozzles in short bursts as the unit travels across the field. These short bursts of water can penetrate the soil to a depth of 6-8 inches depending on soil conditions. In at least one case, the equipment is designed to facilitate back-filling the holes with sand or other soil amendments. The primary benefit of high-pressure water injection systems is that they cause (almost) no visible damage to the playing surface and can be used all season long while the fields are active.

Regardless of which piece of equipment you plan to use, it is a good idea to make sure that the field is not too wet or dry before implementing your cultivation practices. Irrigate the field 12 to 24 hours before you plan to begin your work to ensure adequate soil moisture for proper penetration by the cultivation equipment while minimizing the risk of additional compaction developing as a result of your efforts.

No one piece of equipment will address each and every soil management issue that you might come across while managing your fields. It is my opinion that at a bare minimum, you should have ready access to a slicer and cam-driven core-aerator complete with sets of both hollow core and solid tines to use regularly for managing soil compaction on your fields. ■

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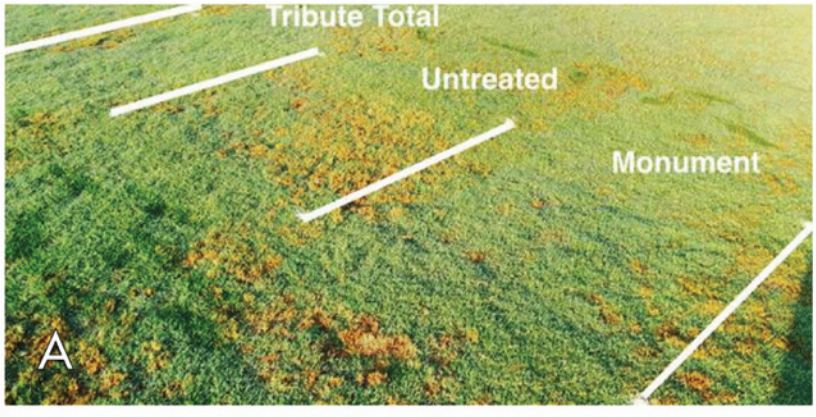
MANAGING WINTER ANNUAL WEEDS



Winter annual weeds such as annual bluegrass (*Poa annua*), henbit (*Lamium amplexicaule*) and common chickweed (*Stellaria media*) often invade cool and warm-season athletic fields subjected to traffic from fall sports such as football and soccer. Traffic can weaken both warm- and cool-season turfgrass athletic fields leaving voids in the canopy for winter annual weeds to invade.

Winter annual weeds will often become established in the most heavily trafficked portions of an athletic field during late fall and early spring once fall sports are complete and turfgrasses are less competitive. In a study conducted during the winter of 2013-2014, plots receiving simulated football traffic in fall contained 35 annual bluegrass plants per 9 ft^2 compared to less than 2 plants per 9 ft^2 those not receiving traffic (**Figure 1**).

Controlling these weeds is essential to maximizing both field safety and playability. Researc h at the University of Tennessee has found that the presence of weeds on athletic fields can reduce traffic tolerance potentially leading to greater injuries. Additionally, failure to remove winter annual weeds will allow them to persist with desirable turf the following growing season (**Figure 2**); which negatively affects field playability and safety as well. To that end, it is important to develop a plan for managing winter annual weeds on athletic field turf.

COOL-SEASON ATHLETIC FIELDS

On many cool-season athletic fields, annual bluegrass is a year round problem rather than something that is seasonally troublesome. Seedhead production

◄ **Figure 1. Top Left: Annual bluegrass** invading trafficked hybrid bermudagrass turf. Few weeds are present in non-trafficked turf.

Figure 2. Non-competitive hybrid bermudagrass growth following use of POST herbicides for annual bluegrass control (A). Additionally, clumps of ryegrass competing with bermudagrass growth on a high school football field (B).

and deposition into the soil profile ensures that annual bluegrass will be a perennial problem on these fields. For example, researchers have reported that annual bluegrass deposits nearly 2 million seeds per ft2 (185,000 seeds per m2) in the top inch of soil. In these instances, climatic conditions usually favor annual bluegrass seed germination and growth for large portions of a calendar year making permanent control with herbicides difficult.

Many field managers have had success managing annual bluegrass with applications of Tenacity (active ingredient is mesotrione). Tenacity is a carotenoid inhibiting herbicide that turns susceptible weeds white after application (**Figure 3**). Researchers have observed that sequential applications of Tenacity in the fall can remove annual bluegrass from Kentucky bluegrass (*Poa pratensis*); however, responses may vary with location, year, or annual bluegrass biotype. Individuals managing fields with high percentages of perennial ryegrass *Lolium perenne*) will need to reduce application rates because this species is less tolerant of Tenacity than Kentucky bluegrass.

In addition to having activity on annual bluegrass, Tenacity can be used to control several winter annual broadleaf weeds, including common chickweed, henbit, and lawn burweed (*Soliva sessilis*) either pre- or postemergence. Label directions allow for Tenacity to be applied for weed control on fields before being re-seeded or sodded as well. However, applications after seeding should be delayed a minimum of 4 weeks or until newly germinated turf has been mowed twice.

Xonerate (active ingredient is amicarbazone) is a new herbicide labeled for use on many mature warm- and cool-season turfgrasses that has efficacy for annual bluegrass control on golf course turf with sequential applications. Despite significant interest among athletic field managers, Xonerate use on cool-season fields is limited because current labeling does not allow fall applications due

▼ **Figure 3. Annual bluegrass bleaching** after treatment with Tenacity

to injury to desirable turf. Additionally, applications in spring must be made before air temperatures reach 85°F. Moreover, applications to Kentucky bluegrass must be delayed a minimum of 12 months after seeding. Research trials have shown some benefit to tank mixing Tenacity and Xonerate for annual bluegrass control in cool-season turfgrass; however, more information is needed before this mixture becomes a labeled option that athletic field managers can legally apply to their turf. At the current time, the best use of Xonerate on athletic field turf is for annual bluegrass control on warm-season fields overseeded with perennial ryegrass for spring football and baseball.

Pylex (active ingredient is topramezone) is a new herbicide for use in turfgrass that is also safe for use on many cool-season turfgrasses including Kentucky bluegrass, perennial ryegrass, and tall fescue (*Festuca arundinacea*). Pylex works similar to Tenacity in that it inhibits carotenoid production, turning susceptible weeds white after application. Pylex is an option for postemergence weed control in established turf and can also be used when establishing new cool-season turfgrass stands from seed. However, applications after seeding should be delayed a minimum of 4 weeks. Although Pylex has**no activity** on annual bluegrass, it can be used to select winter annual broadleaf weeds such as common chickweed, speedwell species, Shepherd's-purse, hairy bittercress, and henbit.

Drive XLR8 (active ingredient is quinclorac) is often thought of as an herbicide for postemergence crabgrass control. Many athletic field managers are unaware that Drive XLR8 controls a wide spectrum of broadleaf weeds including many winter annual species. Drive XLR8 is also safe for use during the establishment of cool-season species used on athletic fields. Applications to newly seeded Kentucky bluegrass can be made 4 weeks after seeding; on perennial ryegrass, Drive XLR8 can be applied at seeding and 4 weeks thereafter as well.

Athletic field managers should be advised that many products containing quinclorac are available under different trade names. Always check the product label to determine if a particular herbicide can be applied to newly established turf. For example, SquareOne Herbicide (active ingredients are quinclorac + carfentrazone) can be applied to Kentucky bluegrass and perennial ryegrass 7 days after emergence. Comparatively, applications of Q4-Plus (active ingredients are quinclorac + sulfentrazone + 2,4-D + dicamba) must be delayed until at least 28 days after emergence.

WARM-SEASON ATHLETIC FIELDS

Winter annual weed management is a critical issue on warm-season athletic fields. As temperatures cool throughout fall and winter, warm-season turfgrasses grow less aggressively and often enter dormancy in many locations. This renders warm-season athletic fields non-competitive against winter annual weed invasion.

There are several factors that make winter annual weed management on warm-season athletic fields complicated including decisions regarding overseeding and managing the evolution of herbicide resistant weeds.

Overseeded Fields. Many warm-season athletic field managers chose to overseed fields with cool-season species such as perennial ryegrass during fall. This practice ensures that fields will remain green throughout the winter and early spring, which can be important for sports like baseball that often begin early in the calendar throughout much of the southern United States. It also serves to protect dormant bermudagrass crowns from the negative effects of foot traffic during dormancy. However, inputs of irrigation water and fertilizer nutrients required to establish a successful stand of overseeded turf on warm-season athletic fields can encourage invasion of winter annual weeds, particularly annual bluegrass. Much like controlling the winter annual weeds; overseeded perennial ryegrass must be removed in the spring for warm-season turfgrasses to recuperate.

One option for annual bluegrass management in these scenarios is to apply a preemergence herbicide like Barricade (active ingredient is prodiamine) 8 to 10 weeks before overseeding. However, in most climates annual bluegrass pressure will likely be quite low during this 8 to 10 week period before fall overseeding. Additionally, this practice may not provide complete control in most environments because multiple flushes of annual bluegrass germination can occur throughout the fall.

Another option is to apply an acetolactate synthase (ALS) inhibiting herbicide such as Revolver (active ingredient is foramsulfuron), Monument (active ingredient is trifloxysulfuron), or Katana (active ingredient is flazasulfuron) closer to overseeding. These herbicides can safely be applied 7 to 28 days before overseeding species such as perennial ryegrass into bermudagrass athletic fields. Be advised that re-seeding intervals vary by product and field managers should consult the herbicide label for more specific information. Applications of ALS inhibiting herbicides will control any annual bluegrass plants that may have emerged before overseeding and provide some residual control of those germinating thereafter.

Some field managers chose to follow-up these applications with postemergence treatments after overseeding. As previously mentioned, Xonerate is a new herbicide that fits this use pattern. Prograss (active ingredient is ethofumesate) is labeled for postemergence annual bluegrass control in overseeded perennial ryegrass turf on

▲ **Figure 4. Many warm-season athletic fields** are not overseeded during the winter and enter full dormancy.

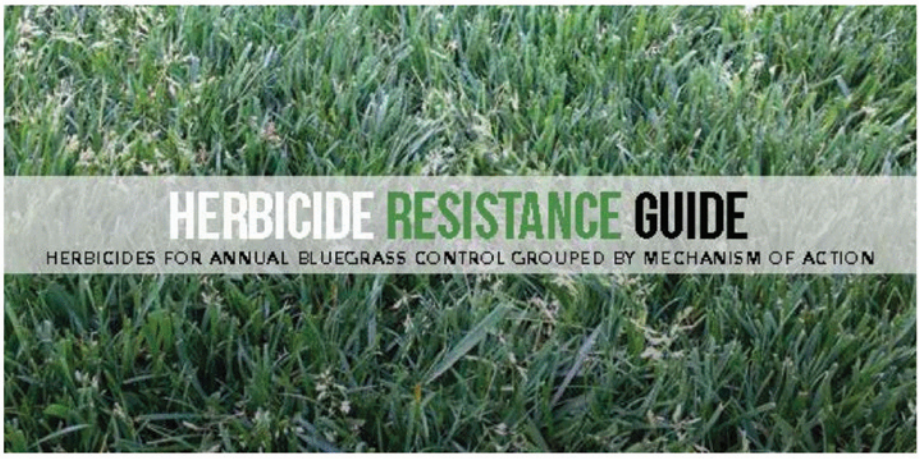
golf courses. Applications are usually made once the overseeded stand has emerged to a height greater than 1 inch and has been mowed at least a single time. Research trials have found that sequential applications of Prograss at this timing in Tennessee effectively control annual bluegrass in overseeded perennial ryegrass fairways. However, Prograss is for use by professional applicators only and does not have specific labeling for use on athletic fields.

Non-Overseeded Fields. Many facilities do not have the resources to overseed their warm-season athletic fields and turf remains dormant throughout the winter and mid-spring (**Figure 4**). In these situations, pre- and postemergence herbicides can be used to manage winter annual weed infestations.

There are numerous preemergence herbicide options for controlling annual bluegrass and other winter annual weeds on non-overseeded bermudagrass including: Pendulum AquaCap (active ingredient is pendimethalin), Barricade (active ingredient is prodiamine), Dimension (active ingredient is dithiopyr), Echelon (active ingredients are prodiamine + sulfentrazone), Specticle Flo (active ingredient is indaziflam), Ronstar (active ingredient is oxadiazon), and Princep (active ingredient is simazine). Most of these herbicides are applied in early fall to provide residual control of annual bluegrass plants not yet emerged from soil for several weeks after application. Specticle Flo, Echelon, and Princep can be applied later in the fall to control newly emerged annual bluegrass plants in addition to offering residual control of plants that have not emerged from soil. Consult a local Extension specialist for specific information about best application rates and timings for these herbicides.

Concerns over traffic tolerance and recovery often result in many athletic field managers avoiding use of preemergence products in fall when fields are subjected to traffic. As a result, postemergence herbicide applications for winter annual weed control are more common on athletic fields. ALS inhibiting herbicides such as Revolver (active ingredient is foramsulfuron), Monument (active ingredient is trifloxysulfuron), or Tribute Total (active ingredients are thiencarbazone + foramsulfuron + halosulfuron) are often applied in spring once turf begins actively growing. Katana (active ingredient is flazasulfuron) is another ALS inhibitor that can also be used for annual bluegrass control in spring if applied following an application of quickly available nitrogen fertilizer at greater than 0.5 lb N/1000 ft2. ALS inhibiting herbicides can be used at low application rates to control annual bluegrass and a wide spectrum of winter annual broadleaf weeds when soil temperatures exceed 60°F. They are commonly applied with non-ionic surfactants at a 0.25% v/v ratio to improve performance.

A common practice in the transition zone is to treat dormant bermudagrass athletic fields with applications of the non-selective



TIMING	ACTION	ACTIVE INGREDIENT*
Pre/Post	Mitotic inhibition	Dimethenamid (Tower**)
		Pronamide (Kerb)
	Photosystem II inhibition	Amicarbazone (Xonerate)
		Atrazine (Aatrex)
		Metribuzin (Sencor)
		Simazine (Princep)
	Cellulose biosynthesis inhibition	Indaziflam (Specticle)
	Lipid biosynthesis inhibition	Ethofumesate (Prograss)
	Carotenoid biosynthesis inhibition	Mesotrione (Tenacity)
	Protoporphyrinogen oxidase (PPO) inhibition	Flumioxazin (SureGuard)

▲ **Figure 5. University of Tennessee,** for selecting herbicides for annual bluegrass control.

herbicide Roundup Pro (active ingredient is glyphosate) to control annual bluegrass and other winter annual weeds. Roundup Pro is labeled for use on dormant bermudagrass turf at rates of 5 to 44 fl oz/A and provides a more economical alternative to many of the ALS inhibitors. Applications must be made to **completely dormant** turf (i.e., no green leaves or stolons present) early in the year at air temperatures > 50F. Be advised that applications under cooler conditions will not be as effective and those made to partially dormant turf can severely stunt spring green-up. Other non-selective herbicides that fit this use pattern include Finale (active ingredient is glufosinate) and Reward (active ingredient is diquat). Be advised that burndown products such as Reward may require sequential applications to provide acceptable control.

Herbicide Resistance. A major factor complicating programs for managing winter annual weeds (particularly annual bluegrass) in warm-season climates is the increasing incidence of weeds exhibiting herbicidal resistance. Weeds are deemed "herbicide resistant" when they are no longer controlled by a rate of a particular herbicide that was once normally effective. Over the past several years there have been first reports of annual bluegrass populations developing resistance to commonly used herbicides including Barricade, Monument, Revolver, Princep, and Roundup. In nearly all of these cases, resistance developed as the result of using the same herbicide for a series of consecutive years without rotation. This all-to-common process essentially removes annual bluegrass plants that are sensitive to a particular herbicide and selects for those with some inherit level of resistance. Recently, populations of annual bluegrass with resistance to multiple herbicidal modes of action have been identified in the southeastern United States.

An increase in herbicide resistant annual bluegrass will result in field managers having fewer herbicide options for annual bluegrass control. Several turf managers are already struggling with the stark reality that resistance brings to light. Imagine annual bluegrass that could not be controlled with Revolver, Monument, or Princep. What about annual bluegrass that remained on dormant bermudagrass fields after an application of Roundup? Continued use of the same weed management strategy for multiple years will eventually lead to this result at some point in time. It is critical that field managers diversify their strategies for annual bluegrass control now and rotate their approach regularly. The University of Tennessee has developed a guide to assist field managers in rotating herbicides for annual bluegrass control in an effort to reduce the rate at which herbicide resistance in turf has been increasing. This document essentially groups products for annual bluegrass based on optimal application timing (i.e., pre- or postemergence) and color codes herbicides by their mode of action (**Figure 5**).

Winter annual weed management is an important issue for individuals managing both cool- and warm-season athletic fields. Failure to control winter annual weeds can negatively affect field safety and playability. Winter annual weeds left uncontrolled often can persist into the following season, competing against desirable turf for valuable water, light, and nutrient resources. It is critical that field managers developing a plan for managing winter annual weeds and commit to rotating their approach regularly to mitigate to the development of herbicide resistant weeds. ■

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John Mascaro's Photo Quiz

John Mascaro is President of Turf-Tec International

Can you identify this sports turf problem?

Problem: Dark green lines on turf
Turfgrass area: Golf tee box
Location: Overland Park, Kansas
Grass Variety: Bentgrass

Answer to John Mascaro's Photo Quiz on Page 23

Background illustration courtesy of istockphoto.com

HOW TO AVOID THE FIELD WORK DAY BEFORE NEXT SEASON

▲ **Turfplaning the outfield** at the University of South Alabama, Mobile. The turfgrass manager is Zach Willard.

As we all realize, maintaining athletic fields and facilities can be a year round job for the coaches, groundskeeper, booster clubs, maintenance staff, etc. So often we hear of coaches setting a work day in January for "all hands on deck" and a long 12-hour or more day is spent edging, painting, cleaning bathrooms, concession stand etc. Here we will hopefully give you some ideas that can be put in place throughout the year that will help you avoid this on a cold, cloudy, dreary January day.

Typically, in most sports, there is some down time for the field. With travel ball, select tournaments and various leagues throughout the country, finding the down time is important and must be scheduled just like the weekend tournaments. Coaches and players might not like having access to the fields, but, if they realize that this is to keep them safe and playable, then it is easier for them to understand.

For timing purposes, we will use the baseball/softball season for colleges/high schools/parks and recreation (typically January 1 through June 30 in the South). As you are reading this, you might think "That doesn't happen at my location," but, with some planning, you can apply these field maintenance practices into your schedule.

JULY

The main focus during this time is your turf health. You want to aerify your fields as soon as possible to help reduce the compaction from the season and aerfiying will create space for the nutrients, water and oxygen to reach the roots to stimulate plant growth. Ideally, you will aerify in two directions immediately after the season to give your turf the most time to recover and become healthy.

Along with aerfiying, you need to topdress with sand (USGA is recommended), but, if budget or availability is a problem, you can use washed, slightly coarser sand. Try to find sand that is free of debris and rocks. After aerifying in two directions, apply a heavy layer of sand up to ¼ inch, then mat drag the field to allow the sand to help fill the space created.

Other things to consider could be: vertically mowing, replacing sod, turfplaning, sand surface leveling of your fields or major renovation projects.

AUGUST

August is a great month to add infield mix to your skinned areas. The weather is warm and drier and therefore infield material will be much easier to work. We will save the discussion for what type of infield mix to use for another day, but, basically the areas you need to address will be: Low spots on your infield; the edges of your grass and skinned infield; baselines; mounds; home plate area holding water in the batters boxes; and bullpen mounds. With the infield and mound work, it is much easier to complete this time of year and will allow for the material to settle and be ready for the season in January. Try to

have your on-field work completed this month before you overseed your field so you won't be driving over your field.

SEPTEMBER

Overseeding is the next step in your process getting ready for the season. A few things to remember and check before you begin your overseeding: Irrigation is key to establishing a great stand of your overseed variety. We recommend taking time about 2 weeks before overseeding to check your system. Monitor all irrigation heads making sure they are rotating properly and getting adequate coverage (head to head). If not, replace or repair at once. By making sure the irrigation is in proper order, it helps with your overseed establishment. Once your irrigation system is working, the next step will be to prepare your field for the seed.

Remove most of the grass on your field by lowering your cutting height while trying to avoid scalping the grass. You will need to remove the excess clippings by sweeping your field to get it clean. Once clean, you can then overseed your fields. Ideally you want to use a drop spreader around the edges (infield, plate, baselines, warning track, etc.) so that you don't spread seed where you don't want it. The drop spreader can be used on the infield and lip areas; make sure you go in two directions with the seed.

For the outfield, you can use a walk-behind rotary spreader or a machine-mounted spreader, also going in two directions. Once you overseed, keep the seed moist until it germinates and then start backing off the water to help the roots establish. If your budget allows, you can add a starter fertilizer approximately 7-10 days after overseeding. We recommend waiting until you see the grass start to push up out of the ground before fertilizing so that the plant can use the nutrients available.

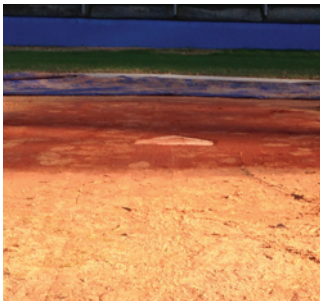
OCTOBER-NOVEMBER

If you didn't get all your clay work completed in August, now is the time to finish it and fine-tune your field. You want to minimize the traffic on your field so that the newly planted overseed won't be damaged and the field will be in great shape for the season. This is a great time to pull out your screens, nets, backstop padding, rail padding, tarps (mound/plate/bullpen), infield protectors, windscreen, etc. You will want to check for holes, tears, rips, etc that might have happened during the off-season. Repair or replace these items now and have them ready for the season in November. As with most items, once the season gets closer, manufacturers get busy and the timeframe is longer to get that replacement. Avoid the rush and shop early for items needed in January!

DECEMBER

Time will move quickly from Thanksgiving to Christmas to New Year's. With the downtime and getting ready for holidays, it is a great time for you to pull soil samples and get them to the lab for analysis. You will want to do this about the same time every year that will help you with your planning for the following year. Soil reports give you the necessary information—the good and the bad. The report allows you to target the areas that are deficient in nutrients. By having this

▲ **Hoover Met Field** overseeded for Hoover High School football. Sam King is the turfgrass manager.



▲ **Left: Leveling home plate** with mound clay at Stone County High School, Wiggins, MS. Field maintained by head coach Hayden Cox. **Right: Adding clay** to the Pensacola Blue Wahoos Field, Pensacola, FL, where Ray Sayre is head groundskeeper.

at the first of the year, it allows you to create a game plan on how to attack your fertilization needs going into the spring. This allows your turfgrass every opportunity to be healthy and grow.

Yearly equipment maintenance and repair can also be on the list of things to do in December. Some things to make sure happen are: sharpen bed knives, grind reels, change oil and fuel filters, replace batteries, make sure tires are in good shape, and repair any hydraulic leaks, worn hoses, etc. Have your equipment ready for the season means one less headache to deal with in January.

JANUARY

Final step is to add your conditioner to the skinned areas. You want to put your conditioner out before you do anything on your field. If you have the December camp and you plan for infield/outfield, then adjust your timeframe and have the conditioner on the field before players are there. The last thing you want to do is to have your field looking great and a 1-day hitting/fielding camp ruin your hard work.

As with most schedules, they can and probably will be adjusted. Take the time to plan ahead. January is a great time to create a yearlong calendar for the field and begin documenting what you do to your field. By doing this, it will allow you to plan for the next year and begin a yearly maintenance/checklist and will help you avoid the "all hands on deck" field day in January. Have a great fall and we'll see you in Denver at the STMA Conference. ■

Bill Marbet is president of Southern Athletic Fields, Inc.; Glenn Lucas is a sales representative for SAF in the South Alabama, South Mississippi and Louisiana, www.safdirt.com.

TURFGRASS MANAGEMENT MATHEMATICS

Recently I returned to the home farm near Cameron, WI where I grew up. We were going to move the last things out of our farmhouse so it could be sold. In amongst the books in the attic was a small thin book called Arithmetic in Agriculture that must have belonged to my father when he as a student in Dairy Science at UW-Madison in the 50's. On the third page of the book, which was copyright 1951, was a picture of a young farmer in bib overalls sitting at a desk with pencil and notebook. The caption read, "Arithmetic will help you solve many farm problems." Think of this for a minute; the problems in this book were meant to be worked out without a calculator, or a smartphone, or calling a friend who is good at math. A slide rule might be helpful; raise your hand if you can work a slide rule! What a great time we live in, because all these tools are available to use today, although phone a friend is a last resort.

A firm grasp of mathematics is also vital for a turfgrass manager. If you make a math mistake you will waste time and money and eventually kill grass. Mathematics allows us to calculate how much of an input to apply, calculate the cost of different applications and determine how many workers or man hours to allow for a project. It is never a bad idea to review and sharpen our mathematical skills and this article is intended to do that. Let's review some principles before we do some calculations.

SIGNIFICANT FIGURES AND PRECISION

How accurate do our calculations have to be? It depends on the situation. If we apply a 2x rate of sand topdressing to a field we will not even notice, but a 2x rate of metribuzin and we may be looking at some dead turf. In general, we match the precision of measuring the material to the amount that is going to be applied. We handle sand topdressing with tractor scoops and topdressers and in most cases two significant figures are all that are needed. A typical π inch topdressing application applies 33 yd^3 tons per acre. The 33 represents two significant figures. An application of ammonium nitrate (34-0-0) equivalent to 1 lb N/1000 ft^2 to the playing surface of a football field would require 169.4 lbs. Do we need this kind of accuracy? Four significant figures? No, in this case we can still use two significant figures and round this number up to 170 lbs.

What if we are making an application of MSM Turf to control wild garlic on the same football field? Using the 0.5 oz per 1000 ft^2 rate this application would take 28.8 oz of product and in this instance we can again use two significant figures and round this number to 29 oz. In the case of smaller areas or products with very small use rates three significant figures may be warranted.

A POWERFUL TOOL

One of the most useful and powerful tools that is commonly used on turfgrass math is the equation of ratios. In many cases we have determined or been given the rate we need for a set area such as 5 oz of product/1000 ft^2 or 2 lbs of product per acre. We know the area over which we will be applying our product and now we must determine how much of the product to apply. For example, the label on kwiksorb wetting agent says to apply 5 fl oz of product per 1000 ft^2 or 218 fl oz/acre. We want to apply this to the playing surface of our sand-based football field that measures 360 ft x 160 ft or 57,600 ft^2. To solve this we set up the following:

$$\frac{5\ fl\ oz}{1000\ ft^2} = \frac{x\ fl\ oz}{57{,}600\ ft^2}$$

In this case our units also align so we do not have to do any conversions at this point. To solve the problem we cross multiply and divide.

$$\frac{5\ fl\ oz \times 57{,}600\ \cancel{ft^2}}{1000\ \cancel{ft^2}} = 288\ oz\ of\ kwicksorb$$

We could also use the rate for an acre (43,560 ft^2) which is 218 fl oz

$$\frac{218\ fl\ oz \times 57{,}600\ \cancel{ft^2}}{43{,}460\ \cancel{ft^2}} = 288\ oz\ of\ kwicksorb$$

In equal ratios the product of the means is equal to the product of the extremes. What does this mean? Let's write the equation a little different. 218 fl oz/43,560 = 288 fl oz/57,600