Author Biography

Professor Henry T. Wilkinson is a world renowned expert on designing, building and maintaining natural grass sports fields. He has worked on soccer (football) fields in Holland, France, England, Scotland and the United States. He has built numerous major and minor league baseball fields through his association with Roger Bossard of Turf Specialists, Inc. Most recently, he has been the lead turf consultant for new stadium construction for the St. Louis Cardinals, Seattle Mariners, Detroit Tigers, Chicago White Sox, and Milwaukee Brewers. Through his involvement with Arena Stadium in Holland, Safeco Field in Seattle and Miller Park in Milwaukee, he has also become the leading turf expert for retractable dome stadiums.

Wilkinson has designed and built little league, softball and municipal sports fields. His knowledge of rootzone and drainage materials, turf and field designs makes him a valuable resource at the University of Illinois.

When asked how he approaches building an athletic field, he states, “First and foremost you must never forget the purpose of the field: athletics. Next, you must use common sense in designing and constructing the field: as simply as possible. Finally, you must design the field with both the construction and maintenance budgets in mind.”

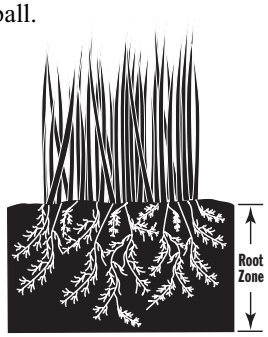
Wilkinson was recognized as *Scientist of the Year* by the Sports Turf Managers Association (STMA) for his work on the use of thermally optimized clay soil amendments to improve grass rootzones.

Types of Grass for Baseball Fields

Baseball fields at all levels of play rely on grass as the cover or surface for most of the field. The most common types of grass used on baseball fields are Kentucky bluegrass in the cooler climates and bermudagrass in the warmer climates. Ryegrass turf is generally not used for baseball because it is slippery and non-repairing compared to Kentucky bluegrass. However, fields that use bermudagrass are generally overseeded with perennial ryegrass in the late fall, to ensure a good quality baseball field while bermudagrass is dormant in the winter months.

Zoysiagrass has been tried in baseball parks, but it is a very slow growing grass and is dormant in the cooler months of the year. In addition, it forms a very dense turf and has stiff leaves. These characteristics cause a moving baseball to play much differently on zoysiagrass than either Kentucky bluegrass or bermudagrass. For these reasons, it is not used in many fields in North America.

While the turf leaves make up the surface that baseball is played on, a good rootzone is essential to achieving a good quality turf grass. The rootzone is the soil under the grass, which supplies grass with water, air and nutrients. If you have a good rootzone, you will have a good turf for baseball.



Rootzones for Baseball Fields

The rootzone should have a depth of 8-12 inches. Any less will limit the potential of the grass, and any more will add little to its growth.

There are four important aspects of the rootzone:

1. Texture
2. Porosity
3. Drainage
4. Chemical reaction

These four factors dictate how well a turf will grow and perform as a baseball field. A brief explanation of these four factors will help you understand how to get the most out of your baseball turf.

Rootzone Texture

Texture is the size, shape and proportion of soil particles. Soil particles are defined by size. They must be able to pass through a mesh or screen having openings 2 mm square. Further, there are three main classes of soil particles: sand, silt and clay. These three natural soil particles come in a wide range of sizes and shapes. Soil particles range in shape from flat to round, and smooth to rough. For example, clay particles are flat, and sand particles are round. If you have a textural soil analysis done, a soil specialist will tell you how much sand, silt and clay you have. Further, a good analysis will tell you how big the sand particles are and what percentage of each size your soil has. This is useful information, but it doesn't tell you all you need to know to estimate soil porosity or the drainage of your soil.

Rootzone Porosity

Pores are the spaces in a rootzone where water and air move and, most importantly, where the roots grow. Pores are generally described by their diameters because it relates to their size. Based on their size, we can estimate whether roots will get the proper air and water they need to grow.

Soil pores are created by the arrangement of soil particles. A soil made up of particles that are all the same size and shape will have uniform soil pore sizes. For example, a sand soil containing only one size of particles will have one size of pores, and these will fill and empty water all at the same time. A clay soil made up of uniform clay particles will also fill and empty water at the same time, but clay is very different than sand. Clay can pull and hold onto water much stronger than sand. The general rule is this: the smaller the pore, the stronger it holds water. Clay can actually hold water so strongly that a grass root cannot absorb it. Sand holds water so weakly that it loses the water to gravity before a grass plant has a chance to absorb very much.

There are very few soils that are completely uniform, but some come close. Most soils are made up of more than one particle size, and this creates soil pores of different sizes in the same soil.

How do you tell what kind of porosity your soil has? It can be measured by experts. It is very important to know, and worth the money. Note the approximate type of soil you have at your site (don't worry about your soil's color) and review the general properties of soils:

Soil Type	Characteristics
Clay	Cracks when dry/slick when wet
Silt or Loam	Commonly referred to as topsoil
Sand	Fast drainage, little water retention
Silt/Clay	Looks like topsoil/cracks when dry
Sand/Silt	Looks like dirty sand

Rootzone Drainage

Drainage is a term that defines how fast a soil both absorbs and evacuates (releases) water. When it rains or you irrigate, the first thing that happens is the water is absorbed into the upper surface of the soil (vertical drainage). This starts very quickly, especially if the soil is dry. But soon after it starts, absorption will slow down. The texture and porosity of a soil determines how fast water will be absorbed by dry soil. A soil that is saturated will absorb water only as fast as it is lost from the bottom of the rootzone. This is called horizontal drainage.

Once all the soil pores are filled with water (saturation), the rate at which water will drain horizontally is a function of how fast it can be removed from the rootzone (drainage system capacity). To speed this up, perforated pipes are usually buried under the rootzone (the drainage system). As you can now understand, there is a lot more to the drainage of a rootzone than just the drainage pipes.

Drainage is very important for both the growth of turf and the game of baseball. The grass needs a rootzone that drains well, so it can receive fresh water and air. A soil that does not drain well will be either too wet (water-logged) or too dry. Either condition will produce poor grass. For the game of baseball, the faster the drainage…the better, so that rain will not prevent or delay games. A rootzone that absorbs and drains water very quickly can absorb an inch of water in 10 minutes and be ready for a game almost immediately. A rootzone can be built from many different soils, and each will drain at a different rate.

For example, a rootzone made up of medium-textured sand can drain water at a rate of 30 inches per hour. However, this is very seldom the case on a baseball field for a simple reason: the grass resists or slows down the rate of vertical drainage. A dense turf growing on a sand rootzone slows the drainage rate to 2 inches per hour. So in the end, the rootzone is very important for ensuring a good drainage system, but the turf is also important in determining the final rate of drainage. The best type of rootzone is one that drains a lot of water quickly, but holds enough for the grass to grow properly.

Rootzone Chemical Reaction

Roots need air, water and nutrients to grow. The soil structure provides the pores and support for roots to get their air and water. The nutrients that the grass uses must be available in the water that is contained in the pores. Grass nutrients are not always in soil water, but are mostly found bound to the surface of soil particles or organic material. Soil particles, especially clay, have charged surfaces, and it is to these surfaces that plant nutrients bind.

Organic matter (dead plant material) is a nutrient source having charged surfaces to which nutrients bind. It would be logical then to have both clay and organic matter in a rootzone, but too much of either of these causes problems for both grass growth and drainage. Clays do not allow for good drainage if they comprise more than 10% of the rootzone material, and organic matter can clog soil pores and greatly inhibit soil drainage if it makes up more than 5% of the rootzone material. You can add or amend soils with materials that will increase the surface charge for nutrient holding and not inhibit drainage. One of these materials is thermally optimized clay soil amendments.

Rootzones and Clay Soil Amendments

A rootzone is the soil in which grass roots grow. Generally, it should range from 8-12 inches under the turf. For a rootzone to support good root growth, it must be porous enough to allow water and oxygen to move through it.

By using a soil amendment, such as thermally optimized clay, you can improve the porosity in your rootzone. In porous soil, the roots absorb water and oxygen, thus allowing them to grow. As the roots grow, the top of the turf (the leaves) will grow too. The better the root growth, the better the turf looks and plays. In addition, good root growth means that many roots will grow deeply into the rootzone. This means stability and good footing for baseball fields.

The second important feature of thermally optimized clay is its ability to hold water and nutrients. Each particle of thermally optimized clay contains thousands of micro-pores and has great surface area, which hold water and retain nutrients for root growth.

Working with Clay Soil Conditioners: Common Application Questions

Can these clay soil conditioners improve all soils?

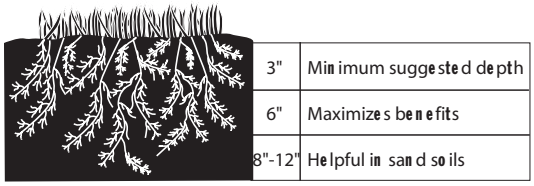
The answer is yes, but some soils benefit more than others. Clay soils and sand soils will probably benefit the most, because they have either too many small pores (clay) or too many large pores (sand). Soil conditioners made from thermally optimized clay can increase both large pore volume and small pore volume, because the overall size of the particles are the same as sand particles while the internal pores are much smaller. When used properly, these conditioners will improve any soil and should never cause your turf to grow poorly.

How are these soil amendments used most effectively?

It is recommended that you always incorporate or till in thermally optimized clay conditioners when using them to improve the rootzone before you plant grass. This can be done with a roto-tiller or soil blender in big operations. You can also mix it into the soil using hand tools for small areas. It is important that the thermally optimized clay be thoroughly and uniformly mixed into the soil. This will ensure you get the maximum beneficial effect.

RULE ONE:
Thoroughly incorporate thermally optimized clay into dry soil for good root growth.

How deep should these soil amendments be incorporated into the soil?



Incorporate into at least the top 3 inches of the soil: the depth at which most of the grass roots will be found. However, for maximum benefit the thermally optimized clay can be incorporated to a depth of 6 inches, which will increase both the stability of the rootzone material and the adhesion of the turf to the ground. Below 6 inches, the benefits from adding any soil conditioner will be small. An exception to this is a sand soil, in which roots will often grow to a depth of 8-12 inches.

RULE TWO:
Incorporate the thermally optimized clay as deep as you expect your roots to grow.

What clay particle size works best for your rootzone?

There are three standard sizes of thermally optimized clay soil amendments in the industry (24/48, 8/16 and 5/30). The 24/48 particle size [Pro's Choice Soilmaster® Plus soil conditioner] is recommended for sand rootzones, such as those found in the newer major league baseball fields. There are also finer-textured products, but these are generally recommended for rapid surface water (puddle) control only.

Pro's Choice also offers two standard sizes: Soilmaster® Select top dressing (8/16) and Soilmaster® infield conditioner (5/30). The following is a general recommendation for using these Pro's Choice products:

Type of Soil	Particle Size	Pro's Choice Product
Natural Soil (high clay content)	5/30	Soilmaster® Infield Conditioner
Natural Topsoil	8/16	Soilmaster® Select Topdressing
Sand Soil	24/48	Soilmaster® Plus Soil Conditioner

Why are various sizes of thermally optimized clay recommended for different soil types?

In natural soils, there is a wide range of soil particle sizes. It is best to have your field soil evaluated, thus ensuring you can blend the best size and amount of thermally optimized clay for your rootzone.

As a general guide, soils can be divided into three categories: those that contain a lot of clay, those we commonly call topsoil, and those that are sand. Research has shown that for soils with a lot of clay, the 5/30 particle size of thermally optimized clay is the best choice. These larger thermally optimized clay particles will both create large pores for root growth and stay "suspended" in the clay (not form layers or settle out).

A topsoil, which has less clay but more silt and sand than most poor soils, will benefit from the stable pores that a thermally optimized clay

will add. Topsoil is generally a heterogeneous soil, having many different soil particle sizes. For this reason, the thermally optimized clay with an 8/16 particle size is recommended. In topsoil, a conditioner with this particle size will stay blended and add permanent pores to your topsoil more effectively than the 5/30 material.

Most sands used for turfgrass rootzones are called medium-textured. For example, golf greens are often specified to be built with predominantly medium-textured sand particles. Recently, professional baseball and even some collegiate fields have started to be built with sand rootzones. A 24/48 conditioner has the same outer diameter as a medium-textured sand. This ensures that it will blend into the sand, and stay blended. Using conditioners that are larger or smaller than medium sand could cause the particles to separate and form layers over time. This separation results in a poor rootzone.

How much Pro's Choice soil conditioner should be blended into the soil?

The amount of soil conditioner you add is critical to achieving the maximum benefits. Remember, each natural soil will be different, so being exact is not possible. The recommendations given below are based on extensive studies at the University of Illinois and feedback from turf managers. They are given as a range. Further, it is extremely important that you do not add too much soil conditioner. Adding too much soil conditioner can result in poor turf performance and even dead grass.

Recommended Ammendment Inclusion for Different Types of Soils

Natural Soils (Clay & Topsoil):		Sand Soils	
Incorporation Depth	**No. of Bags/ 1,000 Sq. Ft.***	**Incorporation Depth**	**No. of Bags/ 1,000 Sq. Ft.***
3 inches	40 - 60	3 inches	60 - 80
6 inches	60 - 120	6 inches**	80 - 160
		12 inches	160 - 320

* Calculations based on 50 lb bags.

** For baseball field construction, it is recommended that you use a minimum of 6-inch depth of incorporation.

RULE THREE:
Add no more soil conditioner than is recommended!

What is the best method for adding soil conditioner to the soil?

The best method to incorporate any soil amendment is to blend the material off-site. This means that you scoop up the soil from your field, use a blending machine to combine the two materials, and then move the amended soil back to the field. This is very expensive and not very practical for most baseball fields.

An alternative is to gradually blend the thermally optimized clay into your field. This will require that the field be stripped of grass (bare soil). The soil should be dry – the dryer the better. Uniformly distribute the recommended amount of thermally optimized clay onto the soil surface. This can be done with shovels and rakes, but a machine will put on the thermally optimized clay faster and more uniformly.

Once the thermally optimized clay is spread out, till the ground to 1/2 of the total depth of incorporation. Then till the soil to the final depth of incorporation. For example, if you are incorporating Soilmaster® soil conditioner to a final depth of 6 inches, run the tiller to a depth of 3 inches, then go over the field a second time with the tiller depth set at 6 inches. The point is to blend the thermally optimized material gradually. This will improve the distribution.

Can I add less than the recommended amount of soil conditioner?

Yes, you can add as little as you want or can afford, but understand that the benefits will also be reduced. It is important to realize that incorporating soil conditioner before you establish your turf is the best and cheapest method. Adding soil conditioner after the turf is established is slow, and the benefits for root growth will be minimal. The depths of incorporation are listed at 3, 6 and 12 inches, but you can also modify this to whatever works best for you.

Is it better to incorporate soil conditioners to a depth of 6 inches, as opposed to 3 inches, even if you can't apply the maximum recommended amount?

Yes, always try to establish a good 6 inch rootzone. In natural soils, add as much as you can, up to the maximum amount, to a depth of 6 inches. In sand, you can reduce the amount (for any depth), but it is recommended that you add at least 1/3 of the maximum amount suggested.

Four Steps to Building Better Baseball Fields

To achieve the maximum benefits from clay soil conditioners when building ballfields, follow these steps:

1. Have the rootzone soil on your baseball field analyzed for texture, drainage and chemistry.
2. Get your soil analysis reviewed by a Pro's Choice soil expert.
3. Have a Pro's Choice soil expert calculate how to improve your soil using Soilmaster® infield conditioner, Soilmaster® Select topdressing or Soilmaster® Plus soil conditioner.
4. Blend in the Pro's Choice product using these guidelines and you are ready to establish your field.