

Breeding Better BLUE GRASSES

By Dr. David R. Huff, Dr. Ambika Chandra, and Jeff "Vern" Borger

The United States is a land of immigrants and so is our most popular sports turfgrass, Kentucky bluegrass (*Poa pratensis* L.). Kentucky bluegrass is native to Eurasia and was brought to North America by the first European settlers as feed

and bedding for their livestock. In this warmer climate, Kentucky bluegrass became naturalized and like the nation's immigrants, Kentucky bluegrass developed and prospered in its use as lawns and sports field surfaces.

American-born sports like baseball and football began using Kentucky bluegrass for its

beauty and durability under intensive use. Unlike any of our other immigrant cool-season turfgrasses (e.g., perennial ryegrass, tall fescue or bentgrass), Kentucky bluegrass is sod-forming and provides superior stability and traction due to its production of underground rhizome stems. These rhizomes intertwine and hold the



Kentucky bluegrass provides excellent low maintenance playing surfaces.
Photo courtesy of Dr. Andy McNitt.

sod together against shearing forces. They also contain growing points called nodes where new plants can begin to develop. Normally new plants form at the tips of rhizomes as they reach the soil surface. However, a deep vertical mowing can cut rhizomes and stimulate the production of new daughter plants all along each rhizome. Turf manager Robert Hudzik uses this feature at Penn State's Beaver Stadium each spring to increase shoot density without additional overseeding.

The aesthetic beauty of Kentucky bluegrass is beyond compare due to its combination of rich green color, medium fine texture, and high shoot density. Its disadvantages include susceptibility to disease and insect pests and a tendency to become thatchy. Just as the rhizomatous growth habit of Kentucky bluegrass creates a strong sod and stable playing surface, these same rhizomes also contribute to the addition of organic matter, underneath the green leaves, called thatch. If the thatch layer becomes too thick (>1/2 inch) then playability may be hindered as the sports field becomes too soft.

In addition, the field will lose some of its ability to grow and recover from damage due to a shallower than normal root system. However, if there is

too little thatch (<1/4 inch), then the field will lose its ability to absorb the impact of participants, increasing the risk of injury and/or reducing traction and the predictability of ball bounce. Properly managing the height of cut and thatch thickness of Kentucky bluegrass creates some of the highest quality sports field in any venue.

In Europe and Australia, perennial ryegrass is favored over Kentucky bluegrass (known in these countries as smooth-meadow grass) for sports fields. Here in America, Kentucky bluegrass has historically been the first choice for sport fields and today is often mixed with either perennial ryegrass or tall fescue.

During the 1980s and 90s, the component percentage of Kentucky bluegrass seed in high maintenance mixtures began to decrease as significant genetic improvements were bred into the turf-type perennial ryegrasses. In other words, genetic advances in traits like higher shoot densities, darker green color, and shorter stature began to give perennial ryegrass a quality that rivaled that of Kentucky bluegrass, and subsequently perennial ryegrass use increased in the sports turf market.

During the same time, similar genetic gains were also being realized in tall fescue. Genetic improvements in Kentucky bluegrass have lagged behind those of either perennial ryegrass or tall fescue for the simple fact that Kentucky bluegrass does not normally reproduce seed through a sexual process. The breeding system of Kentucky bluegrass is known as apomixis, which results in the asexual (without sex) production of seed. This means that every seed produced is genetically identical to the plant that produced it, or in other words, a genetic carbon copy of the seed-bearing parent. As such, attempting to bring together traits from different parents or improving a trait through artificial selection is nearly impossible. Thus, new types of Kentucky bluegrass only occur when the apomixis system malfunctions and produces

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The aesthetic beauty of Kentucky bluegrass is beyond compare due to its combination of rich deep green color, medium fine texture, and high shoot density.

an off-type, or an aberrant, progeny.

Most aberrant plants are quite unacceptable for turf, however, and so tens of thousands of seedling bluegrasses need to be grown in order that just a few aberrant plants can be detected that might exhibit potential improvements. Once a superior plant has been identified, then the rest of the breeding process is comparatively easy because apomixis is a great way to preserve the genetic makeup of the superior plant and to produce genetically uniform seed. But finding an aberrant plant that exceeds the performance of any of today's top cultivars is no easy challenge. Nonetheless, the need for improved cultivars of Kentucky bluegrass remains strong because as Dr. C. Reed Funk, Rutgers University, would say, "We have a lot of good cultivars of Kentucky bluegrass, but we don't have any great ones."

Because of this need for improved bluegrasses, breeders refocused their energies over the past 15 years and have developed a

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The high level of visual and functional quality of Kentucky bluegrass sports fields is difficult to achieve with any other grass.

A-34 KBG Reville HBG



Kentucky bluegrass x Texas bluegrass hybrids like the cultivar Rev are beginning to add significant improvements to bluegrass adaptability. Photo courtesy of Dr. James Read.

wide range of new Kentucky bluegrass cultivars (go to www.ntep.org for the latest list of cultivars along with their performance ratings from across the country). As a result of these improvements and perhaps a regained appreciation for Kentucky bluegrass's sod forming ability, the percentage component of Kentucky bluegrass in mixtures with perennial ryegrass has slowly been increasing over the past 7-8 years. Sustaining our focus on breeding improved bluegrasses, we should expect genetics improvements to continue in the coming years.

No easy task

When the time comes, choosing the right cultivar of Kentucky bluegrass for a specific use is not necessarily an easy task for the scientist or the turf manager. Basically, there are types of Kentucky bluegrasses that perform best during the spring and fall seasons and other types that perform best in the summer months. There are Midwestern common types, mid-Atlantic common types, and then there are those that nobody has quite figured out what type they are (the Miscellaneous types).

The types typically preferable for sports fields are the aggressive types and the compact types; however, these types also possess particular management requirements and may not be the right choice for everyone. Thus, the selection of which Kentucky bluegrass cultivars to blend together for a sports field depends on your application and turfgrass management resources. Since any single cultivar is only a single individual (genotype), it is best to blend several cultivars together to create some genetic diversity in order to better combat disease and other unpredictable stresses.

One of the beautiful features of Kentucky bluegrass as a whole is that there are a lot of different types of cultivars to choose from to best match your needs. Do your research and choose your cultivars wisely!

Some of the newest breeding efforts with Kentucky bluegrass have involved its hybridization with Texas bluegrass (native to North America) which has deeper roots, deeper rhizomes, and better heat tolerance. Normally, when two different species are crossed, the resulting progeny are reproductively sterile. For example, a mule is sterile because it is a cross between a donkey and a

horse and the only way to get a mule is to make the cross. However, the Kentucky/Texas bluegrass hybrids are selected for their apomitic form of seed reproduction and therefore entirely avoid this genetic sterility barrier. The newest Kentucky/Texas bluegrass hybrids still lack the high turf quality of pure Kentucky bluegrass cultivars but they are beginning to make an impressive impact in turf areas reserved for low maintenance and will only improve in quality as the breeding efforts continue.

Maintenance of Kentucky bluegrass can be much different than the maintenance of pure tall fescue or perennial ryegrass but neither tall fescue nor perennial ryegrass have the rhizomatous feature of Kentucky bluegrass (including the so-called "rhizomatous tall fescues"). As budgets allow, the most important management practices to institute for any sports field are regular mowing, followed by a nutrition program (fertilization), and finally an irrigation system. When all three are combined, a very suitable field can be created. Supplementing these practices with core cultivation to alleviate compaction, vertical mowing to manage thatch, and topdressing and overseeding will only enhance the quality, safety, and durability of multi-use sports fields.

Kentucky bluegrass management is as much an art as a science. For example, Kentucky bluegrass seed is notoriously slow to germinate (10-21 days). Researchers have found that soaking bluegrass seed overnight (allowing it to drain during the day and repeat the next night) in their original woven seed bags, using a water-filled garbage can, followed by air-drying enough to flow through a seed spreader, starts the germination process and greatly enhances its establishment rate. So the next time you need to resurface or build a sports field, put Kentucky bluegrass on your list of choices. Although Kentucky bluegrass is an immigrant, its use on sports fields is as American as apple pie. ■

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