



Paspalum vaginatum, 'Excalibur,' has excellent tolerance of saline water supplies and provides a very good playing surface.

The Best Choice May Not Always Be Your Favorite

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WHILE PLAYING a round of golf, the topic of regrassing a tee with creeping bentgrass came up for discussion between two friends. Although bentgrass has an excellent reputation in certain areas of the country, its performance on tees in Southern California has been less than ideal on courses with heavy play.

"Why creeping bentgrass?" asked the first.

"Because it's my favorite," was the reply.

"Then why do you drive a station wagon?"

After a brief moment of silence, "Because I need room for the family. What's your point?" was the answer.

"The point is, you didn't buy a car based on an impulse, so why would you choose creeping bentgrass based on one?" replied the second.

During the renovation of an existing course or the construction of a new facility, the decision must be made as to which turfgrasses will be established. For the individual entrusted with this responsibility, mental pictures of beautiful, virgin golf holes immediately come to mind. This perfection, more

often than not, includes favorite turfgrasses, meticulously manicured and offering the best possible playing conditions.

For the average person, the criteria used to select the favorite turfgrasses for greens, tees, fairways, and roughs include:

- thick turf density
- dark green color
- uniform appearance
- excellent playability

Using this short list of criteria, it is likely that the details of each person's mental image will be slightly different.

For example, the fairways in Mr. Smith's image would be established with hybrid bermudagrass, while in Mr. Jones's they would be perennial ryegrass.

Because it is intuitively apparent that not every turfgrass species or cultivar can be maintained successfully in all geographic locations, one man's dream can easily turn into another's night-

mare. This nightmare would be that of the golf course superintendent, who is normally held responsible for the condition of the course.

Since it is not always possible to select favorite turfgrasses for establishment, then how does one make the best selection? The answer involves considering other criteria that account for variations at each course. These criteria

could include climatic adaptation, irrigation supply and water quality, soil conditions, availability of pesticides and fertilizers, and the golfers' desires and demographic profile. While these factors may not be the only ones required to make the "best" selection, they are among the most important considerations.

Climatic Adaptation

Perhaps the best understood dimension of climatic adaptation is the varying tolerance of turfgrass species or cultivars to heat and cold extremes. An example of this is the poor adaptation of creeping bentgrass to summer extremes on putting greens in South Florida. There is only a modest period during the year when conditions are favorable for creeping bentgrass growth. Outside of this period, temperatures and humidity extremes can cause severe thinning.

Judging climatic adaptation of turfgrasses, however, is not always as easy as just considering heat or cold tolerance. Another point to consider is whether the turfgrass is capable of quickly recovering from damage when exposed to heavy play. If not, it might require complete or partial reestablishment each year.

As an example, consider the establishment of zoysiagrass fairways at a location well north of what is commonly considered the transition zone. In this location, zoysiagrass would survive summer and winter extremes, but because its dormancy period would overlap heavy play during the spring and fall, the fairways would be severely damaged by traffic and divoting.

If you are unfamiliar with the normal and extreme climatic conditions of a new location, the National Climatic Data Center in Asheville, North Carolina, provides public information about all major U.S. cities.

Irrigation Water Concerns

No matter where a golf course is located, the topic of irrigation cannot be taken lightly. There is no better time to address this topic than when selecting a turfgrass species or cultivar for establishment. To make the best selection, though, the topic of irrigation must be considered from two viewpoints.

First, there is the obvious concern of water availability, which may be controlled either by economics or by governmental regulation. In California,

Future water availability should not be taken for granted when selecting turfgrass species for establishment, as witnessed by the low water level in this reservoir.



for example, the cost of irrigation water can run as high as \$340 per acre-foot. Considering that an average 18-hole course can consume as much as 700 acre-feet in one season, the annual water bill can easily exceed a quarter of a million dollars! On the other hand, in Arizona, each course is permitted to use a specified quantity of water that often is less than what is needed to maintain ideal playing conditions.

Realizing that water availability would become a turfgrass industry concern in the '90s and beyond, the USGA, in cooperation with the GCSAA, organized a committee in the early '80s of leading turfgrass experts to begin funding water-related research projects at several universities across the country. Initially, this research effort focused on (1) identifying the genetic drought resistance mechanisms of turfgrasses with minimal irrigation requirements, and (2) developing a better understanding of drought resistance itself.

During these initial studies it was discovered that the variation in irrigation requirements can be as great between the cultivars of individual species as it is between the different species themselves. Knowing this information, the best decision can be made with respect to selecting the best adapted turfgrass species and cultivar.

Furthermore, selecting the best turfgrass in relation to irrigation requirements may require considering different ranking criteria in semi-arid and arid climates versus humid climates. In semi-arid and arid climates, it may be best to select a turfgrass with a low evapotranspiration rate; in a humid climate it would be more appropriate to select a turfgrass with good drought tolerance. The difference between these areas of the country is that soil moisture recharge is solely dependent on irrigation in semi-arid and arid climates, whereas periodic rainfall normally can be expected in humid climates.

As a follow-up to identifying genetic drought resistance mechanisms, the USGA/GCSAA Turfgrass Research Committee has also funded several breeding programs that are producing new turfgrasses with greater genetic water conservation capabilities. To date, these programs have produced Sahara bermudagrass and several soon-to-be-available cultivars of buffalograss and zoysiagrass.

Water quality is another factor to consider when selecting turfgrasses, especially as it relates to salinity. The



By establishing Kentucky bluegrass fairways in adapted areas, only the greens need to be treated for snow mold activity.

focus of water quality concerns generally has been restricted to the arid West. Salinity problems, however, are also becoming prevalent in other regions due to saltwater intrusion along coastal areas and the increasing use of effluent water sources.

Taking into account salinity in the process of turfgrass selection involves interpreting chemical analysis tests. Of

greatest concern are (1) the total concentration of soluble salts, expressed in units of electrical conductivity (mhos/cm), and (2) the amount of sodium and bicarbonate in relation to calcium and magnesium, expressed as the Sodium Absorption Ratio (SAR).

In cases where the total concentration of soluble salts exceeds 0.75 mhos/cm, and the expressed ratio of sodium in



Turfgrass durability is a growing concern for the golf course superintendent as a result of the increasing popularity of golf.

relation to calcium and magnesium exceeds 10, selecting turfgrasses with high salinity tolerance would be prudent. For example, Fairbanks Ranch Country Club in Rancho Santa Fe, California, uses an irrigation supply containing a high concentration of soluble salts, and has established its fairways and rough with Excalibur, a cultivar of *Paspalum vaginatum*. This particular turfgrass has a very high tolerance of saline conditions, provides an excellent playing surface, and is adapted to many of the warmer climatic zones of the country.

Soil Factors

Due to the wealth of knowledge about the discipline of soil science, usually it is possible to overcome crippling problems relating to physical compaction or soil nutrient composition in most locations. These adjustments typically involve special culti-

vation equipment, topdressing with sand or other appropriate amendments, and/or the application of specially blended fertilizers.

In some cases, there are circumstances in which potential problems can be minimized by selecting turfgrasses with a low irrigation requirement or a slow vertical leaf extension rate. Fine-textured soils that restrict water percolation or turf areas associated with severely sloped banks or mounds serve as good examples.

In regions with a Mediterranean climate, such as Southern California, the list of climatically adapted turfgrasses includes all of the major cool- and warm-season species. Golf courses in this area that exhibit poor drainage characteristics can select one of several warm-season grasses with a low evaporative loss rate, thereby lowering irrigation needs for fairways and rough.

In the other example, many golf courses have been constructed with

severely contoured banks and mounds to accentuate their design and are difficult to irrigate and mow. To minimize future maintenance, establishing these areas with turfgrass species or cultivars exhibiting slow vertical extension rate and a low irrigation requirement would be recommended.

Availability of Pesticides and Fertilizers

After the major agronomic circumstances have been accounted for in the selection process, the next step is to consider current and future limitations in the availability of agricultural products, including pesticides and fertilizers. To do so, a complete list of known pests, including insects, weeds, and diseases for each turfgrass candidate should be assembled.

Since it is essential that each list be as complete as possible, consultation should be sought with local and

regional turfgrass authorities. These authorities could include neighboring golf course superintendents, university extension personnel, USGA Green Section staff, and other knowledgeable industry professionals.

With lists for each turfgrass candidate having been completed, a list of the pesticides required to control each pest can then be made. With this information in hand, it may quickly become evident that certain turfgrasses should not be selected because of a governmental restriction on the use of a particular product. For example, in some areas of the country, the application of certain fungicides for snow mold control is limited to their use on greens and tees. Under these circumstances, creeping bentgrass established on the fairways could be particularly susceptible to severe damage during the winter months.

This particular selection criterion can also be viewed from a different angle. Given the public's growing environmental awareness, it will become increasingly important for the turfgrass industry to respond, where possible, by establishing turfgrasses that require fewer pesticide and fertilizer applications.

Fertilization is another environmental factor worthy of consideration. When estimating total fertilizer requirements for each turfgrass candidate, remember that healthy turfgrass is more resistant to weed invasion and

disease attack. With this in mind, do not underestimate fertilizer requirements. Reducing applications in the field could inadvertently increase the demand for herbicide and fungicide applications, nullifying the original intent of the turfgrass species or cultivar selection.

Golf Activity

Having considered agronomic limitations and the well-being of the environment, it is also necessary to take into account the amount of play anticipated on the course. This can be accomplished by estimating the maximum number of rounds expected and the anticipated maintenance budget. These estimates will provide a basis for determining (1) the possible need to select turfgrasses with maximum durability, and/or (2) limitations caused by the inability to complete the cultural requirements of a specific turfgrass due to heavy play or a low maintenance budget.

The *Los Angeles Times* recently reported that, at 135,000 rounds per year, Rancho Park Golf Course is the city's most heavily played course. This figure translates into 370 rounds per day, 365 days per year. Taking into account the short daylight period during the winter, daily play during the summer can exceed 450 rounds. To maintain dense turfgrass under such extraordinary circumstances requires

working with only the most durable turfgrasses.

Interestingly, public facilities like Rancho Park Golf Course are large revenue producers; hence, you would think that the maintenance staff should have plenty of resources to maintain the course. To accommodate 450 rounds per day, though, requires scheduling foursomes off the first tee every seven to eight minutes from dawn until dusk. This heavy volume of play, unfortunately, makes it impossible to follow through with the cultural demands of some turfgrasses.

Alternatively, the maintenance of a golf course also can be limited by low play. While affluent memberships at private golf courses can raise membership dues to compensate for low play, golf courses that depend on income from green fees often must slash the maintenance budget to stay afloat.

Conclusion

In too many instances, the selection of turfgrasses for a site is based on an impulse rather than pertinent selection criteria. In reviewing criteria for selecting grasses for your site, be sure to include consideration of agronomic circumstances, environmental quality issues, and anticipated play. And don't be too disappointed if your favorite grass does not turn out to be the "best" selection.

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CULTIVATION HAS CHANGED

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FOR MANY YEARS golf course superintendents had relatively few choices for cultivation techniques: hollow-tine core aeration, slicing units, and pin spiking. Several versions of each cultivation technique were available, but all were confined to the surface 2 to 3 inches of soil. Though attempts at deeper cultivation were made, these units were too slow or heavy for commercial acceptance. Thus, cultivation programs could only deal with surface-related soil physical problems, including surface compac-

tion, surface-located layers, and heavy (fine-textured) surface soil texture which limited infiltration of water. A second effect of limited equipment choices was that cultivation programs essentially were standardized. For example, on cool-season turf, core aeration was performed in spring and fall, slicing any time of the year, and pin spiking in the summer months.

Tremendous advances in turfgrass cultivation equipment have occurred during the past ten years. The most significant change has been the develop-

ment of deep soil cultivation for turfgrass sites. Deep cultivation allows for alleviation of adverse soil physical problems that occur deeper in the profile, including soils with high silt or clay contents throughout the rootzone, compacted zones buried during construction, layers within the rootzone that impede water movement or rooting, and problems related to sodic soils.

Currently, several units can penetrate to a depth of 6 to 16 inches, including the Aerway slicer, Deep-Drill aerofier, Turf Conditioner, HydroJect, contain