Golf courses using bermudagrass have a choice of overseeding for winter play. Overseeding is necessary where cold weather causes bermudagrass to go dormant or grow too slow to maintain a satisfactory putting surface throughout the winter. A wide selection of seed mixtures is available that provide excellent results. Only quality seed should be considered. The information on the seed label includes the variety, purity, weed content and percent germination. The amount of pure live seed is important and can mean the difference between a good or poor stand.

Several factors affect an early superior playing quality. Bermudagrasses are very competitive with cool-season seedlings if the overseeding is accomplished too early, while warm temperatures persist. The date of seeding can vary greatly from south to north where bermuda is used and greens are overseeded for winter play. Earlier overseeding will be completed by September 15 and there will be a 15- to 20-day difference in seeding dates from north to south about every 150 to 250 miles. From the Atlantic to west Oklahoma and Texas, the following general seeding dates are suggested. If a golf course is overseeded more than nine months, the use of bentgrass should be considered. Using east to west Interstate Highways as guidelines —

1-40 and south  
September 15 to October 1
1-20 and south  
October 1 to October 15
1-10 and south  
October 15 to November 15
1-4 and south  
November 15 to January 1
or no overseeding

Many fungicides are available to protect seedlings while they are becoming established and to assure a good putting surface. Throughout the winter season, stay on a preventive program to keep disease from becoming a problem. There should be enough material on inventory at all times for at least two sprayings.

Ryegrasses emerge readily and produce a smooth putting surface within three to five weeks, depending on the management of the green. The first cutting of new selections of perennial ryegrasses should be at about 5/16 to 3/8 inch. This will allow better root development. Gradually lower the cut to minimize irregular roll of the ball. Perennial ryegrasses are more cold tolerant, more disease resistant and make a finer putting surface than domestic annual ryegrass; however, there can be a variability in the putting quality of the perennial ryegrasses dependent on the grooming practices. There can be two transitions: during overseeding and during the spring and early summer, when the cool-season grass begins to die. Poor transition in the spring or early summer distracts the golfer. No disturbance of the putting surface is desirable. Properly groomed bermuda greens can be overseeded with minor disturbance to the putting surface. During overseeding, however, the seed should be worked down close to the soil for best germination.

Soils of The Southwest

Technically, most soils in Nevada, Arizona, New Mexico, and much of southern California are aridisols, soils with surface layers low in organic matter and, in the natural state, dry most of the year. Most of these soils contain layers of clay and calcium carbonate or gypsum. Calcium carbonate is most common, and it often forms a hard layer known locally as caliche, similar to what is called limestone on the East Coast. Calcium carbonates are common in all soil horizons, often existing as a coating on grains of sand. Because aridisols have not been leached, they are high in all nutrients except nitrogen. Unless the pH has been lowered, the availability of phosphorus may be low, and iron will be severely tied up.
Salt accumulation may become a problem after a few years of irrigation on poorly drained soils. This happens because these soils are high in salts, causing runoff water, which eventually is used for irrigation, to be high in salts. Because the evaporation rate is high, the salts from the water and the salts from the soil have a tendency to accumulate in the surface layers. Much of the water used in the Southwest comes from wells. This subsurface water is often higher in salts than runoff water, but more importantly it is often high in sodium. Therefore, there is a greater need to use a little extra irrigation water occasionally to flush the sodium and other soluble salts from the root-zone.

Soils of the Southwest typically are thought of as being relatively young soils because they are not highly weathered. The sand and fine gravel particles in the soil generally are not smooth-edged or rounded as they are on the East and West Coasts. It is very difficult in this region to find sands that have most of their particles in the medium and fine sand fractions necessary to construct putting greens according to USGA specifications. Almost never is a sand found that is well sorted in this region. Most sands in the area contain everything from gravel to silt, and they often contain too many particles in the very coarse and coarse sand fractions.

The soil pH typically exceeds 7 and runs up to the low 8s. A pH higher than 8 indicates the presence of significant amounts of sodium. Because of the high pH, iron and phosphorus are relatively unavailable to plants because they are generally tied up in insoluble calcium compounds. Acidifying the soil with sulfur or sulfur-containing materials helps make these nutrients available for plant growth and may substitute in part for applying iron as a nutrient. Acidifying the soil also tends to improve the soil's infiltration and percolation characteristics by dissolving some calcium carbonates, which otherwise accumulate on the outside of the sand grains and act as a plugging mechanism in these soils under low rainfall or irrigation with high-calcium waters.

**Most Soils** of the Southwest do not benefit from gypsum applications because of their already high calcium levels. However, it is not uncommon that greens constructed with a high sand content will benefit from applications of gypsum at the rate of 10 pounds per thousand square feet monthly during the main season of heavy irrigation. The reason for this is that the gypsum modifies the irrigation water, particularly well water, which is often high in sodium. High concentrations of sodium can produce a layer 1 1/2 to 2 1/2 inches down in the soil profile which, in the summer, creates a stench caused by anaerobic respiration. In other words, because of poor soil structure, not enough oxygen enters the soil to satisfy all the microbes in the top two inches and all the aerobic (oxygen-needing) microbes below this level. A substantial amount of easily digestible organic matter in this area is then worked on by anaerobic organisms, causing a black, odorous condition to develop in the soil. Roots of creeping bentgrass and bermudagrass grow poorly, if at all, in this layer.

In Arizona particularly, but also in other parts of this region, the problems encountered with organic matter and sodium in the water bring about a reluctance to include organic matter in the mix when building greens. This is a subject on which more research is needed as it relates to specifications for putting greens. Some of this much-needed research, as it pertains to the USGA Green Section specifications for putting green construction, is currently under way at Texas A&M under the direction of Dr. Kirk Brown.

An excess of soluble salts is usually not a major problem in these soils, but should always be considered as a potential problem in the Southwest. Soils high in salts are often found in low areas where runoff waters accumulate. There can be lenses of salt buried in soils and these can occasionally cause a problem. Typically, the biggest problem is use of water, particularly subsurface water high in salts when it is used on soils that have poor internal drainage. Such conditions result in serious accumulations of salts, and they could reach the point where the cool-season grasses, even bermudagrass, have difficulty growing. Water quality, therefore, is a problem, but we are fortunate that turfgrasses can better utilize low-quality water than many other crops.

If creeping bentgrass is to be used on putting greens, an adequate percolation rate must be established. If the greens are constructed to USGA specifications, or constructed so they have similar percolation rates, it is possible to flush out excess salts regularly to prevent their accumulation. However, it is difficult in summer when night temperatures are hovering above 90 degrees and daytime temperatures are well above 100 degrees to consider overwatering greens to flush out the soluble salts. If this is done on greens with poor internal drainage, the roots will die because of the lack of a sufficient supply of oxygen to continue normal respiration. When the soil temperature is at 90 degrees, roots and microbes use up oxygen at a rapid rate. Thus, turf can be lost rather quickly, and superintendents with bentgrass greens find themselves walking a thin tightrope through the summer season. If the greens are mostly Poa annua, they walk an even thinner and more treacherous tightrope.

**In summary**, soils of the Southwest are typically very fertile, and salts are not usually a problem. Where water quality is a problem and where calcium carbonate accumulations occur, sulfur and sulfur-containing materials can be used to reduce pH and increase the availability of iron and phosphorus for plant growth. Finally, good internal drainage is most critical to the successful growth of creeping bentgrass putting green turf in this part of the country.