A STRONGER SOD

The cornerstone of quality sod is shear strength, which comes about only after strict turfgrass management principles are implemented.

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In sod production and athletic field management, strong, tear-resistant turf is desirable. Sod producers and installers want sod that holds together for trouble-free harvesting and installation. Athletic field managers want tough, shear-resistant turf to maximize footing and minimize player injury.

Anywhere turf is being used to provide stable footing for athletic or recreational use, good root systems are important. Recreational turf managers desiring to maximize turf shear strength need to set up management programs that put into practice principles that maximize sod shear strength.

Shear strength of turf is the force required to tear or break a turf apart. It is one of several components that influence the tendency of a turf to "fail" or provide inadequate footing. Other factors such as root-soil binding force, soil moisture and texture, leaf succulence, etc. can also influence the tear resistance of a turf. The force with which roots bind to soil is a major factor relevant to athletic field footing.

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Cleat damage is one of the negative side effects of turfgrass with inadequate root development.

Binding tendencies

Anyone who has compared the force required to pull Kentucky bluegrass and goosegrass from the soil realizes there are great differences in root-soil binding tendencies of grass plants. Kentucky bluegrass does not appear to bind as strongly to the soil as perennial ryegrass. However, "knitting" together of Kentucky bluegrass by rhizomes does give bluegrass an ability to hold together as a sod better than perennial ryegrass.

Most work on turfgrass strength has been done measuring the force required to break the turf apart after it has been exposed to various management practices. Little work has been done on the other factors influencing the tear resistance of a turf. Developing a management system that maximizes root production is obviously important to maximizing turf strength whether one is managing weakly soil-blended Kentucky bluegrass or strongly soil-bound perennial ryegrass.

Rhizomes and stolons contribute to turfgrass strength. However, root mass near the surface of the soil and the tendency of the roots to bind to soil are also extremely important factors.

Other factors

Nutrition, genetics, moisture, temperature, mowing, light, hormones, compaction, herbicides, diseases, insects and nematodes are major factors that affect the development of a root system. All of these factors function as links in a chain. If any one of these is not being dealt with then root production can suffer.

Although all nutritional elements and soil pH are important to root production, phosphorus and nitrogen appear to be the most influential. Of these two, nitrogen is most often mismanaged.

Research and practical observation has illustrated that late fall fertilization of Kentucky bluegrass, creeping bentgrass and tall fescue leads to increased density, root growth, drought tolerance and fall to spring color, as well as decreased spring mowing (when contrasted with spring fertilization) and decreased weed and summer disease problems.

Excessive spring and summer nitrogen stimulation of cool-season grasses produces green, thin-celled leaf tissue at the expense of stored food reserves and root system. It is this same depleted, stored food energy pool that is called on to heal traffic damage, mobilize disease resistance mechanisms and provide energy during extended periods of drought. Therefore, depleting stored food reserves through nitrogen mismanagement is frequently the cause of poor summer turf quality.

The N factor

Research on tall fescue-Kentucky

Recreational turf managers need to implement programs that promote the development of a strong, deep root system. Among the most important management factors are proper nutrition and moisture levels, temperature, mowing height and others.

bluegrass sod has illustrated the inverse relationship between nitrogen and tall fescue-Kentucky bluegrass shear strength. This same work was unable to establish a definite relationship between nitrogen and root number in the surface 3/4 inches.

The principle of excessive nitrogen reducing bermudagrass shear strength has been illustrated by Mitchell and Dickens. They examined the impact of nitrogen fertilization on the sod strength of Tifway and Tifgreen bermudagrass and showed a tendency for 0.5 lb N/1000 sq. ft. applications at 4 week intervals to produce greater shear strength than 2 lb. N/1000 sq. ft. applications at either 2 or 4 week intervals. Therefore, moderate levels of nitrogen application appear to be important in the development of maximum shear resistance in both cool-season and warm-season grasses.

Choosing aggressive varieties that perform well in your region is a particularly important. A variety may have superior shear resistance in one region of the country and have susceptibility to a disease in another region. Such a condition minimizes the importance of shear strength because the disease destroys turf quality.

Proper moisture

In the transition zone, Kentucky bluegrass varieties such as America, Victa, Sydsport, Georgetown, Cheri, Vantage, Baron, Ennundi, Classic, Merit, Midnight and Gnome have provided a good combination of quality and shear resistance.

Maintaining adequate but not excessive moisture on athletic field turf is critical. Wet turf will certainly shear easier than dry turf. There is the practical management concern of needing to maintain enough moisture in the profile to keep root hairs alive while not putting so much moisture in the soil that increased comparison and shear damage is likely.

Aerification is a management practice that is absolutely essential to the quality production of turf on an athletic field.

Soils are more prone to compaction damage when they are near field capacity. Therefore, allowing fields time to dry prior to compacting events will certainly reduce compaction-related problems and minimize shear strength. Likewise, fast use of rain tarps prior to events can prevent significant loss of turf shear strength.

Maintaining athletic fields with excessive moisture also leads to succulent leaf tissue which reduces footing.

Cool-season grass root production is going to be maximum during spring. There is a secondary burst of root growth associated with the cool weather of fall, but it is paltry compared with spring root production.

Summer's high temperatures are going to minimize the potential to increase shear strength through summer root generation. Syringing of athletic turf will be helpful in reducing the mid-summer root dieback caused by excessive high temperature.

The drought resister

The bermudagrasses are, of course, very capable of sustaining good root growth through hot summer temperatures. As temperatures cool in the late summer and early fall, bermudagrass root growth will slow, naturally decreasing shear resistance. This lost shear strength can be minimized with the use of plastic and geotextile tarps that trap heat and keep the bermudagrass green and growing roots.

Maintaining proper mowing frequency is critical to maintaining the maximum root system and shear strength. Actual mowing frequency needs to be geared to the growth rate and frequent enough to not be removing more than 1/3 of the existing green tissue with any one mowing (excessive defoliation of turfgrass has been shown to cause substantial root dieback).

There is a direct relationship between shoot tissue and the amount of root system that can be sustained by it. Obviously then, higher mowing heights will lead to greater root production. Whether or not a higher mowing height will lead to increased shear strength is not clear.

Agronomic principles dictate that higher mowing heights will produce greater root systems. However, higher mowing heights did not produce greater sod shear strength on tall fescue-Kentucky bluegrass mixtures and Tifway and Tifgreen bermudagrass.

Mowing frequency

Work by Jusks and Hansen on Kentucky bluegrass has demonstrated that more frequently mowed turf has less potential for root, rhizome and shoot production. Kentucky bluegrass maintained at a two-inch mowing height and mowed 5 times a week had 21 percent less root system and 34 percent less rhizome growth than the same turf mowed once per week. In this same study, turf mowed at one inch and mowed 5 times per week had 46 percent less roots and 45 percent less rhizomes. Therefore, maintaining a reasonable mowing frequency and mowing height will likely maximize shear strength by maximizing root and rhizome development in Kentucky bluegrass.

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Maintaining sharp mowers is also important in developing shear strength. It has been demonstrated that dull mowers significantly reduce turf quality, increase leaf spot disease activity and increase gasoline consumption by 22 percent.

Obviously maximum light absorption is desireable. This generally will maximize food production if temperatures are not excessive. Shaded turf tends to have thinner cell walls and be more prone to traffic injury. Excessive use of non-ventilated rain tarps can lead to inefficient use of stored food reserves in respiration. Therefore, quick removal of rain tarps is important to maintaining good shear strength.

Hormones affect roots

Preliminary research at Virginia Tech by J.M. Geatley and R.R. Schmidt, discussed in the Virginia Tech Field Day Reports in 1987 and 1988, has demonstrated substantial root and shoot stimulation of turfgrass using seaweed extractable cytokinios and "cytokinin-like" fungicides.

It is known that hormones do control root and shoot growth and once the mechanics of how to utilize hormones with maximum efficiency is worked out, it is possible that increased shear strength will result.

Their research has demonstrated increased shear strength on Kentucky bluegrass sod utilizing "cytokinin-like" fungicides such as propicanarable and triadimefor.

Compaction will reduce shear strength by its negative effect on root growth and turf quality. A management program that includes aggressive aerification coupled with good traffic control, irrigation management and turfgrass selection can help minimize this negative impact. Capital improvements that provide efficient irrigation design, modification of soils to resist compaction and installation of drainage will all help to reduce this negative impact of compaction.

Phosphorus and nitrogen appear to be the most influential nutrional elements on root production. Of the two, nitrogen is most often mismanaged.

Aerification desired

Coring aerification increases air exchange, water infiltration, water retention, nutrient penetration and thatch decomposition while decreasing surface water runoff and irrigation frequency. It is a management practice that is absolutely essential to the quality production of turf on an athletic field.

Herbicides have the potential to harm turfgrass if improperly used. Most broadleaf herbicides, when applied in accordance with label recommendations, do little damage to turfgrass root systems. However, some preemergence and postemergence annual grass control herbicides do have the potential to reduce root system development even when used at recommended rates. Therefore, it is wise for athletic field managers and sod producers to critically scrutinize the data with regard to the potential of their preemergence herbicide to cause root pruning.

Work on cool-season grasses suggest that bensulide, pendimethalin and prodiamine have the potential to root prune Kentucky bluegrass and reduce shear strength. Likewise, bensulide and metribuzin do have potential to reduce bermudagrass root development.

Pest control

Timely and effective control of diseases, insects and nematicides is obviously important as these pests have tremendous potential to reduce turf quality, root growth and turf shear strength.

In summary, utilize low to moderate levels of nitrogen and adequate levels of supplemental nutrition. Select the varieties that have the greatest potential for providing the best combination of mowing height and frequency that removes no more than 1/3 of the existing green tissue. Remember that low mowing heights and intense mowing frequency reduce root and rhizome development in Kentucky bluegrass.

Minimize the negative effects of compaction through implementation of an aggressive aerification program.

Carefully select preemergence herbicides to minimize the potential for root pruning. Maximize pest control effectiveness by applying the most efficacious materials at the proper time and in accordance with label directions. **LM**