Turf Management for Root Growth

While top growth may enhanced the aesthetic appearance of turf for sport, it is the root growth which provides stability to the total system.

The principle function of the root system of a plant is to absorb water and nutrients. A secondary function is to anchor the plant. For the sports turf manager the secondary function is of prime importance in resisting the tear or shear of the plant from the soil material by the cleat on the athletes shoe. Management of the turf to maximize the strength and depth of the root system, therefore, becomes of prime importance to him.

Root growth is influenced by environmental factors beyond the control of the turf manager, such as soil temperature and day length. The maximum and minimum temperatures for root growth are lower than for shoot growth. While optimum top growth of bluegrass may occur at 21°C, optimum root growth of the same species will be at 15°C. Fortunately the shading effect of the top growth will often result in a temperature gradient of this degree between air temperature and soil temperature.

Root growth continues to occur in the soil until the ground is frozen. Thus dormant nitrogen applications are successful due to continued root activity, although top growth has ceased and mowing has stopped in the late fall. The rate of root growth increases as the day length increases in the spring and falls off as the days become shorter in the fall.

The factors which influence root growth that the sports turf manager has a degree of control over are soil physical conditions, fertilizer use, mowing and irrigation.

Soil Physical Conditions

The most significant soil physical condition affecting root growth is compaction. Compaction acts in two ways in reducing root growth. The first is the reduction of non capillary pore space which impedes the movement of oxygen to the root and the discharge of carbon dioxide from the root zone. The second, which is combined with the reduction in oxygen supply, is the physical impediment of root penetration through the soil mass. Research has demonstrated that roots may grow at oxygen concentration 1\20th that found in the atmosphere, thus the primary effect of compaction on root growth is the physical impediment to root growth and the build up of carbon dioxide and other gases.

Drainage is another soil physical condition affecting root growth. Again restriction of aeration due to the non capillary pores becoming filled with water results in a lack of oxygen supply to the roots. Not only is surface compaction serious but compacted layers at depth can lead to temporary perched water tables which restrict the depth of rooting above the compacted layer.

Fertilizer Use

A part of fertilizer use is the modification of soil pH. The optimum pH for turf production is 5.5 to 7.0. pH values greater than 7.0 are seldom detrimental to root growth until the pH levels are in excess of 9.0. Values below 5.5, however, are most damaging to the grass root system due to the increase in solubility of manganese and aluminum which have a severe toxic effect on the root system.

Nitrogen is the key element in the production of grass species and a positive

response to increasing rates of application of nitrogen are generally observed. This positive response does not continue indefinitely because at a certain point there becomes insufficient carbohydrate produced by photosynthesis to convert all the available nitrogen to protein. At this point there is a distinct suppression of root growth and depth and carbohydrate reserve storage. Likewise rhizome and stolon growth are reduced. At the same time there may be no discernable reduction in top growth.

Phosphorus increases root development. Due to the low solubility of phosphorus in soil and the restricted downward movement from surface applications, phosphorus may be restricted to the surface one or two inches. Therefore, the full effect of phosphorus on root development, particularly for deep rooting may be lost. Thus in the construction of new facilities it is important to mix adequate phosphorus in the root zone material before putting it in place.

Potassium also influences root development, particularly the branching of the root system. It also plays a role in synthesis of carbohydrate required for root growth.

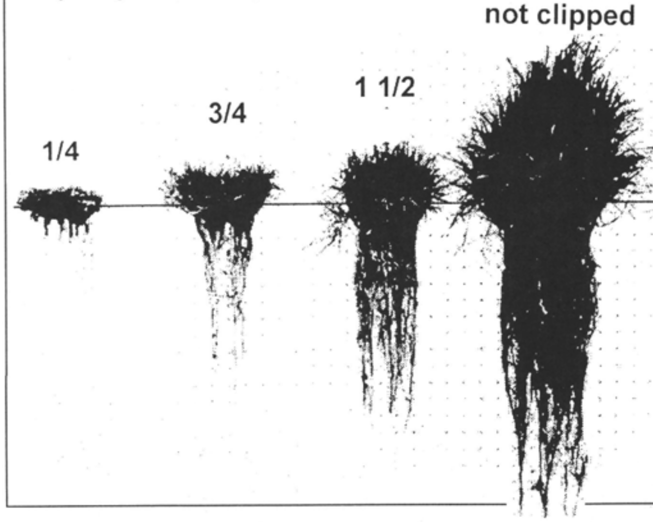
Mowing

The cutting height used for a given sport use is a compromise between the demands of the specific game involved and the physiological principles that influence the health and vigour of the turf species.

Few turfgrass species tolerate continued mowing below 10 mm or maintain adequate turfgrass uniformity and sod cover at cutting heights above 100 mm. Close mowing not only reduces the density and depth of the fibrous root system, it also reduces the rate of rhizome and stolon elongation (Fig.1).

Cutting height has a greater effect on root growth and carbohydrate reserves than cutting frequency. Minimal effect on root growth occurs when less than 1/3 of the total leaf area is removed. This rule of thumb establishes the frequency of mowing; the higher the cut, the less frequent the mowing. Bentgrass maintained at less than 10 mm may need daily mowing, whereas bluegrass mowed at 100 mm may need mowing every 7 to 10 days.

Fig. 1: The influence of cutting height on the root growth of Kentucky bluegrass (Courtesy of Elliot C. Roberts, The Lawn Institute)



Irrigation

Frequent, light irrigation has been known to cause shallow rooting. At the inception of a water stress there is an increase in root growth, however, as the plant approaches a wilting condition photosynthetic activity declines with a corresponding reduc

Root Growth
Continued from page 11

tion in root growth. This relationship between water supply and root growth suggests that the turf manager would be advised to allow the root zone to dry to near the wilting condition before irrigation Water budget systems for scheduling irrigation can prevent over irrigation while giving guidance for when wilting may occur.

The rhizomatous Kentucky bluegrass has a more rapid recuperative potential than most other cool season grasses following a period of moisture or heat stress.

Longevity

The longevity of root life varies with species from less than six months to a maximum of two years. Kentucky bluegrass tends to retain its root system for more than one year, whereas perennial ryegrass, the fescues and the bentgrasses will replace their root system at least once each year. Roots originating in the fall live longer than roots initiated in the spring. Roots associated with flowering tillers usually die shortly after seed set. Rhizome and root initiation stops within 24 hours after severe defoliation and does not become significant until shoot growth recovery is well advanced.

Welcome to Our New Members

Richard Levac, City of Cornwall
Scott Olan, Univ. of Toronto
Ron Pansino, Univ. of Toronto
Mike Weiler, Pickering College, Newmarket
Richard G. White, Nanaimo, BC.

COMING EVENTS

January 7, 8, 9, 1997
Ontario Turfgrass Symposium
Venue: Constellation Hotel, Toronto
Contact: Office of Open Learning,
Room 160, Johnston Hall,
University of Guelph,
Guelph, ON.
(519) 767-5000

February 7 and 8, 1997
Niagra Parks Alumni Assoc.
Educational Conference,
Venue: Ameri-Cana Conference Centre,
Contact: Michael Scmahl
(905) 687- 3307
or
Russ Nutley,
(905) 627-3783

SPORTS TURF MANAGER is the official publication of the SPORTS TURF ASSOCIATION of ONTARIO.

It is published quarterly by the Association for free distribution to its membership. An annual subscription may be obtained at a rate of $25.00 per year. Calling card size advertisement space is available.

For further information contact:
The Sports Turf Association,
328 Victoria Road S.,
GUELPH, ON. N1H 6H8
(519) 763-9431
FAX: 519-766-1704
EDITOR: Dr. R.W. Sheard, P.Ag.
DESIGN & GRAPHICS: Willustration
PRINTING: Moffitt Print Craft

ISSN 1201-3765

Sports Turf Association Office Hours

Mrs. Sonja Schneider will be in the office from 9:00 a.m. to 1:00 p.m., Monday, Wednesday and Friday. The office phone number is (519) 763-9431. At other times a message may be left on the Voice Mail system. Please include the vital information of name, telephone number with area code, and time of calling. The office may also be reached at any time by faxing 519-766-1704.