

Turf Biology

Introduction

Turf is a multi-million dollar industry, in the U.S. the annual cost to maintain turf is estimated to be more than \$10 billion. We grow turf as a: a) carpet surrounding our homes to reduce dust, mud, glare and heat b) to play on, and c) for the sheer beauty of seeing large swaths of green grass. Unfortunately the more successful the turf is, the greater the stress is on the individual plants as they compete for the limited resources. Reducing stress by cultural practices that take into account the growth habit of the grass plants and the seasonal changes in environmental stressors should be followed.

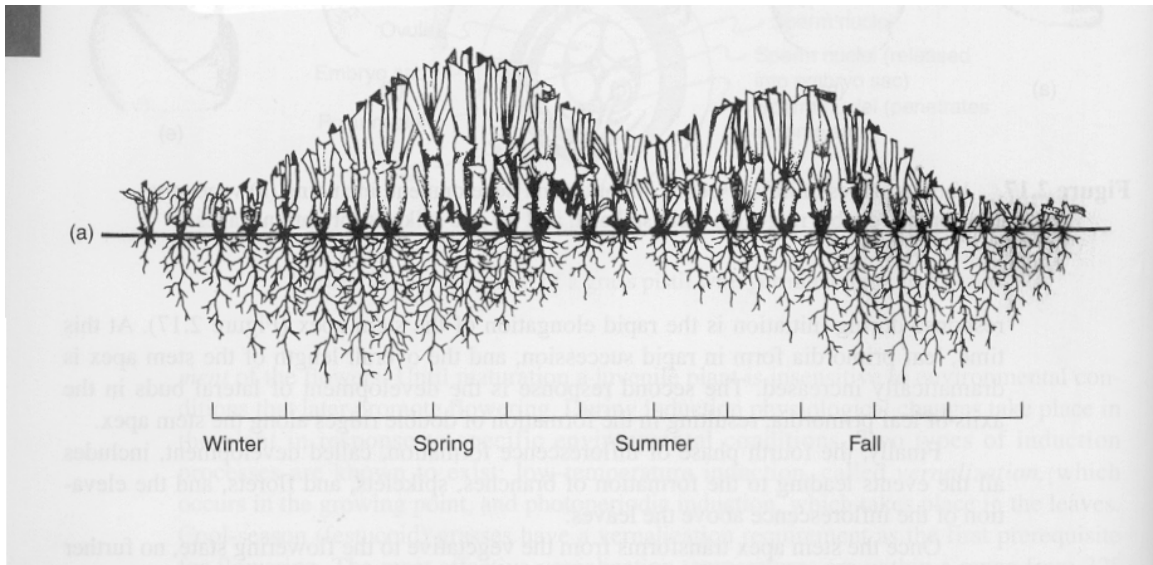
Turf is an ideal plant for monoculture because it rejuvenates itself continuously. Turf species have a limited height, though the leaf blade grows after cutting from an intercalary node just above the soil. It produces new shoots from creeping horizontal stems replacing old shoots, which die over time. Turf grass species have the ability to cover vast areas.

In Ottawa the two grasses used to create turf are Kentucky Bluegrass (*Poa pratensis*) and Red Fescue (*Festuca rubra*) because they have fine textured leaves, and are plants with similar colour. The Kentucky Bluegrass loves the sun whereas the Red Fescue tolerates some shade so the dominant grass species changes in the lawn gradually from one to the other grass species depending on the sunlight.

It is interesting to note that Kentucky Bluegrass is not native, it was probably introduced at Vincennes Indiana by the French in 1720 but by the end of the Civil War it was so well established that the settlers thought it was a native species.

Seasonal Growth

Kentucky Bluegrass and Fescues have a bimodal growth pattern. In the early spring the roots begin to grow into the soil followed by the shoots. By mid spring the roots have reached their maximum depth and the growth slows down but the shoots continue to grow rapidly. In early summer the roots and shoots are short, this occurs after bloom time and is the time the plant may go into dormancy. The shoots start to grow more rapidly in late summer and by fall the roots are growing deeply into the soil again. The grass plants tiller rapidly in the fall creating new plants vegetatively.



Turf Grass Management by A. J. Turgeon, Fifth Ed., Page 38

The reason for the reduced growth in summer is either low light levels or reduced levels of carbohydrates stored. The stored carbohydrates keep the plant alive during times when it is using more than photosynthesis is making. Storage occurs when there is slow shoot growth (fall) but during rapid shoot growth (spring) the carbohydrates reserves are used up. The more rapid the shoot growth is in the spring the more depleted the reserves are during the summer period when the plant needs the reserves the most. Grass plants don't photosynthesize during the hot dry times in summer because the rate of respiration exceeds the rate of photosynthesis and they would lose moisture if they opened their stomata. Nitrogen fertilizers applied at high rates in the spring encourage rapid shoot growth but fewer carbohydrates are transferred to the roots so they become shorter more quickly than untreated turf areas. Nitrogen fertilizers applied in the spring depletes the level of carbohydrates in storage as summer heat and water stresses approach.

Turf will go into a semi-dormant stage in summer if high temperatures are accompanied by dry soil conditions. In August when the night becomes cooler the grass comes out of dormancy. It begins growing but more energy is used for propagating vegetatively by spreading than growing shoots so the clippings are shorter than in the spring. Turf makes many tillers and rhizomes in the fall.

Implications

Watering

Turf should be watered in accordance with the temperature and depth of root growth. This would mean that in spring and fall the watering would be deep but once the night temperature is warm the watering should be shallow, frequent and done during the heat of the day to reduce heat stress. The roots are shallow therefore they can not grow down deep into the soil to retrieve water and minerals in reserve in the underlying soil, they must rely on water in the top layer of soil. The plants close their stomata once the internal temperature is approximately 35° C or if the internal leaf humidity drops below 100%. The internal leaf temperature exceed the air temperature because it is exposed to sunlight, so a brief watering at noon reduces the leaf and soil temperature while putting the water in the root zone at the very time the plant most needs it. The

most recent recommendations coming out of research stations is to water 1/8 of an inch every day at noon during the hot part of summer.

Small reductions in plant moisture affects, turf greatly because 90% of the total mass of a healthy grass plant is water. Transpiration of water through the stomata helps reduce the ambient temperature surrounding the leaf. This reduces the stress experienced by the plant. It is not unlike the effect perspiration has on reducing our internal body temperature.

Mowing

Set the lawn mower to 7cm and mow frequently, generally once a week. The longest time frame is 10 days apart, because taking small portions of the plant off at any given time is preferable to cutting off large portions. Don't cut off more than 1/3 of the plant at a time. Short lawns look neater but they suffer more stress and have shorter roots and fewer new plants are made. This means that short lawns need very careful management of the watering, fertilizing and mowing to survive through the summer months.

In the heat of the summer the grass is not growing as much so the mowing frequency can be reduced but do not reduce the height of the plant. Short clippings fall down between the grass plants where they mulch the soil, reducing temperature increases caused by the sun, and helps trap soil moisture in the root zone.

Studies show that earthworms ingest the clippings at night further increasing the fertility of the soil. In fact in a series of studies done in Illinois the health of the turf relied on the worm population. In one study thatch was removed from a field leading to the migration of the worm population and in another the worms were killed, creating deep thatch. In both instances the turf suffered and the soil became compacted and less fertile. Feed your worms their favorite food; grass clippings and they will aerate and fertilize the soil.

The nutrient ratios of clippings are; 5 Nitrogen: 2 Phosphate: 3 Potassium plus trace minerals. The Nitrogen alone can amount to several pounds/1000 sq. ft. during a growing season.

Thatch

Thatch is a favorite food for earthworms and does not cause problems unless it is greater than 1/4" (pencil thickness) in depth. It can be a problem on a lawn that is intensely fertilized and watered or on a lawn that receives infrequent mowings. Pesticide use is also implicated where thatch build up is problem because the pesticides reduce the number and diversity of the soil organisms. Reduce the cause of the thatch buildup by changing the maintenance practices. Topdressing is the most effective way to treat thatch. Use a screened topdressing soil applying a thin layer to accelerate the decomposition of the thatch.

Fertilizing

Fertilizing Kentucky Bluegrass in the spring can lead to shorter roots, longer shoots and reduced carbohydrate reserves. These factors make the grass plants less tolerant to summer heat and water stress. On the other hand fertilizing in the late summer will create greater vegetative propagation as it will encourage rhizomes and tillers. This is the time to apply fertilizers for a healthier lawn.

Nitrogen produces deep green leaves, rapidly growing leaves and shorter roots. Phosphorus facilitates metabolic functions plus energy storage and use. Potassium is used to create cell components, and it helps regulate respiration and transpiration. It helps the plant grow, cope with environmental stress and resist disease.

Aeration/coring and slicing

These practices improve the soil structure by decreasing the compaction of the soil and increasing the aeration. It would be best to do them in Ottawa in the late summer instead of early spring for many reasons.

- 1) Cold damp soil should not be walked on until all the (gravitational) water in the large pore spaces has drained away. Otherwise compaction will be increased.
- 2) Cores must be filled in with a topdressing material otherwise the lawn will be lumpy and the soil at the edge of the holes will dry out in the hot days that start in May.
- 3) Kentucky Bluegrass and Fescues become stressed in summer (June and July) but grow well in the late summer and fall. Late summer or fall aeration would encourage more tillering and propagation during the least stressful time in the growing season.

cc. City of Ottawa

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