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Turf Grass TRENDS

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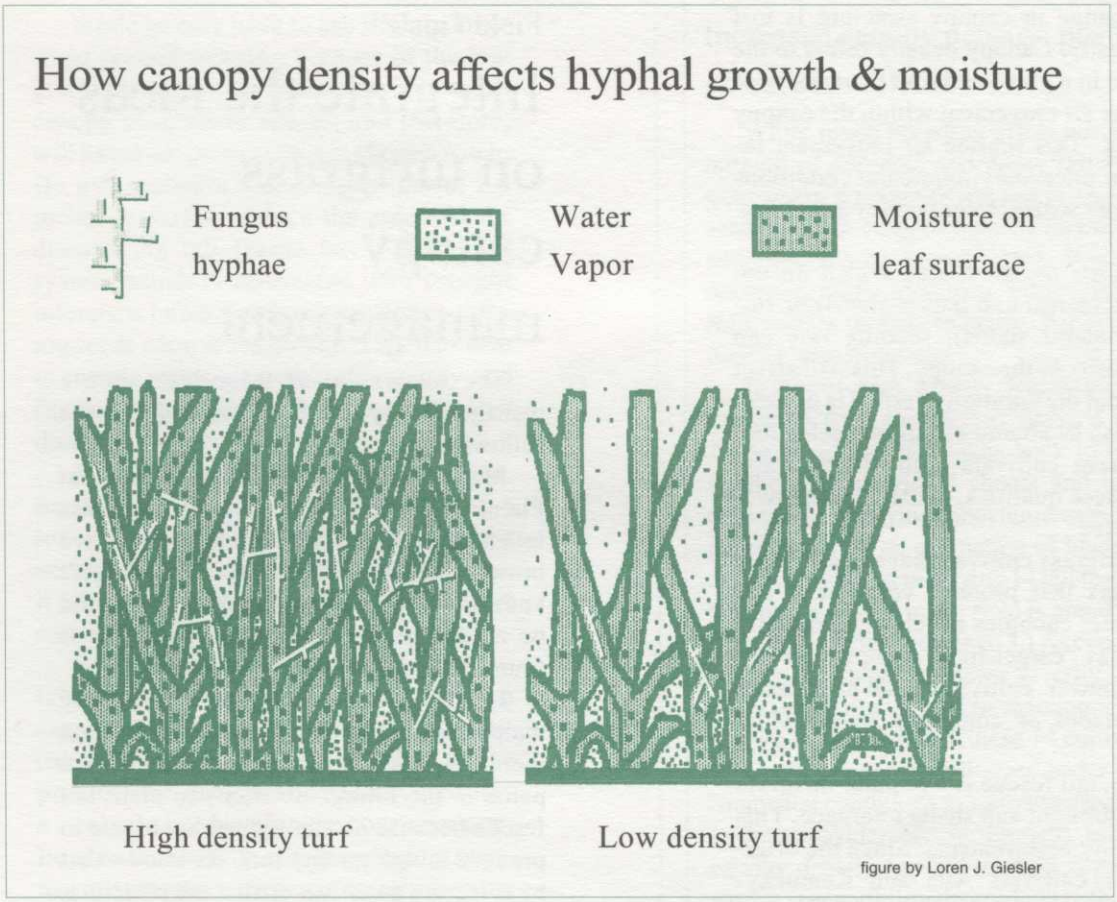

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The turfgrass canopy and its environment

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A canopy is often thought of as the leafy portion of a tree or shrub, but turfgrasses can also be thought of as having a canopy. Picture yourself in a typical forest canopy. You are surrounded by living plant tissue. Notice how cool, dark, and damp it is within the canopy even though it may be a hot, dry, sunny day. The forest foliage influences the environment within the canopy (the micro-environment) and causes conditions within the canopy to be greatly different from outside of the canopy, or the ambient environment.

In a similar manner, the turfgrass canopy is formed by overhanging foliage. Micro-environmental conditions within the turf canopy can vary markedly from ambient conditions and can greatly affect the activity of organisms (i.e. turfgrass diseases). Little is known, however, of what effects turfgrass management practices have on the canopy environment.

Changing the canopy

The physical structure of turfgrass canopies is regularly altered by management practices, and therefore the canopy micro-environment is also changed. An obvious alteration is mowing, which affects the height of the canopy. As the height of a canopy is lowered, air mixing within the canopy extends to the soil surface. This results in drier canopy conditions in lower cut canopies.

A more subtle change in canopy structure is turf density or canopy density. Canopy density refers to the total number of blades in a given area. As the density of a canopy increases, the air movement within the canopy becomes more limited. This limited air movement results in much different micro-environmental conditions as compared to a canopy with greater air movement (i.e. low density canopy).

For turf species such as tall fescue which do not spread by rhizomes (underground lateral stems) or stolons (above-ground lateral stems), seeding rate can directly impact the density of the canopy. This will affect other species as well, but the duration of effect is limited. Canopy density can also be altered by cultivar selection. All species of turf have cultivars with different and unique qualities. Of these qualities, density and growth habit are normally listed.

In recent years, turfgrass cultivars have been developed by plant breeders that produce very dense and compact canopies. These canopies are chosen primarily for aesthetic reasons, as "carpet-like" canopies are desired. Many of the newer cultivars also have more delicate, less rigid blades as compared to the older releases.

In the Great Plains, tall fescue is a popular turfgrass and is selected for its drought and shade tolerance. This turf also has low fertility requirements. Since the original release of tall fescue cultivars 'Alta' and 'Kentucky-31' in 1940, many cultivars have been developed. Tall fescue cultivars are classified into three main groups (Tall, Medium, and Dwarf). The tall cultivars are represented by the original releases and are sometime referred to as forage-type tall fescue cultivars. While it is not well documented, the tall cultivars are associated with low density canopies and have upright growth habits and do not generally produce dense canopies unless seeded at high rates at the time of establishment. This association is thought to be due to the input of resources available to the plant into top-growth instead of root-growth or shoot production.

The medium and dwarf cultivars are the newer released cultivars and generally produce low growing and dense canopies. This reduces mowing frequency and decreases lawn refuse. Currently, there are over 100 tall fescue cultivars available to select from. New, dense cultivars have been suggested to have increased disease problems and this has been confirmed for brown patch disease by research conducted at the University of Nebraska.

Field Tips

Integrate the ideas on turfgrass canopy management

The integration of these ideas into a management system is demonstrated in the following example.

Mark is a turfgrass manager in the Great Plains. He will be establishing turfgrass into an area which has been known to have brown patch problems. (Even if he doesn't know that brown patch is present this would be a safe assumption, as the pathogen is found nearly everywhere.)

He also anticipates that this turf will be maintained under high maintenance, and therefore, has a higher potential for brown patch in the future. He wants to plant tall fescue because he can reduce his inputs to produce a high quality turf. He knows that by selecting a cultivar with a tall structure, a canopy with reduced density will be established. He can plant at a seeding rate of 6 lbs/1000 ft^2 or less.

Brown patch disease and tall fescue as a model study system

Brown patch is the most destructive disease of tall fescue from the Southern U.S. through the Great Plains. Also known as Rhizoctonia blight, this disease is caused by the fungus *Rhizoctonia solani*, which is a widespread inhabitant of soil and thatch. Typically, the disease causes large brown patches which can range from a few

inches to over two feet in diameter. Individual diagnostic lesions on the blades are irregular-shaped, bleached areas with dark margins. Spread of the disease occurs through the movement of infected grass blades or growth of the fungus through the canopy by hyphae, or thread-like strands.

As with all turfgrass diseases, infection by the brown patch fungus and the development of symptoms are affected by environmental conditions. Environmental conditions which favor growth of the fungus in a canopy are warm temperatures (night temperatures above 60° F and daytime temperatures above 85° F) and high relative humidity or free leaf moisture.

Disease development is also determined by the influence of weather on the host. In the Great Plains, the disease typically occurs during the hot summer months, when the cool season grasses are stressed. In contrast, brown patch disease in the southern U.S. occurs to a greater extent in early spring and fall, when warm season grasses are more stressed by cool temperatures. We have found in our research that the severity of brown patch disease development during these favorable weather periods can be reduced by cultural practices.

Increased canopy density: positive attribute or potential problem?

While much breeding effort has gone into the development of compact and dense tall fescue cultivars, the question of whether or not this is a positive attribute does arise. Studies comparing cultivars of tall fescue for their susceptibility to brown patch disease have been conducted at many locations within the U.S. One piece of information lacking in many of these reports is a canopy density measurement.

In our research, canopy density is quantified by extracting plugs from the canopy using a standard cup cutter. These plugs are then taken back to the laboratory where numbers of individual shoots and blades per shoot are counted. Multiplying shoot number by the number of blades per shoot gives an estimation of blade density for a given canopy. In studies involving 14 tall fescue cultivars, we find that susceptibility in the field is greatly affected by canopy density. (See figure on page 5.) As canopy density increases so does brown patch disease severity. This relationship has also been demonstrated in agronomic crops.

We have also tested these 14 cultivars for their susceptibility to brown patch disease under uniform micro-environmental conditions in a growth chamber, and found them to vary considerably. In the field, however, the effects of canopy density appears to mask differences among cultivars in susceptibility determined in the growth chamber. In fact, levels of brown patch disease are higher for the resistant cultivar as a group than for the susceptible cultivars.

We also tested seeding density, as another cultural practice which can greatly modify the canopy environment, for its effects on brown patch disease. Experiments with a tall type cultivar 'Fawn' showed that increasing seeding rates result in increased brown patch disease up to two years into a planted area.

In a study in which tall fescue 'Fawn' was seeded at 2, 6, and 10 lbs/1000 ft^2, brown patch disease severity increased with increasing seeding rates. In the first year of establishment, twice as much disease activity was observed in the highest seeding rate as compared to the lowest seeding rate. In the second year, disease severity was approximately 20% lower in the low density canopy than the high density canopy.

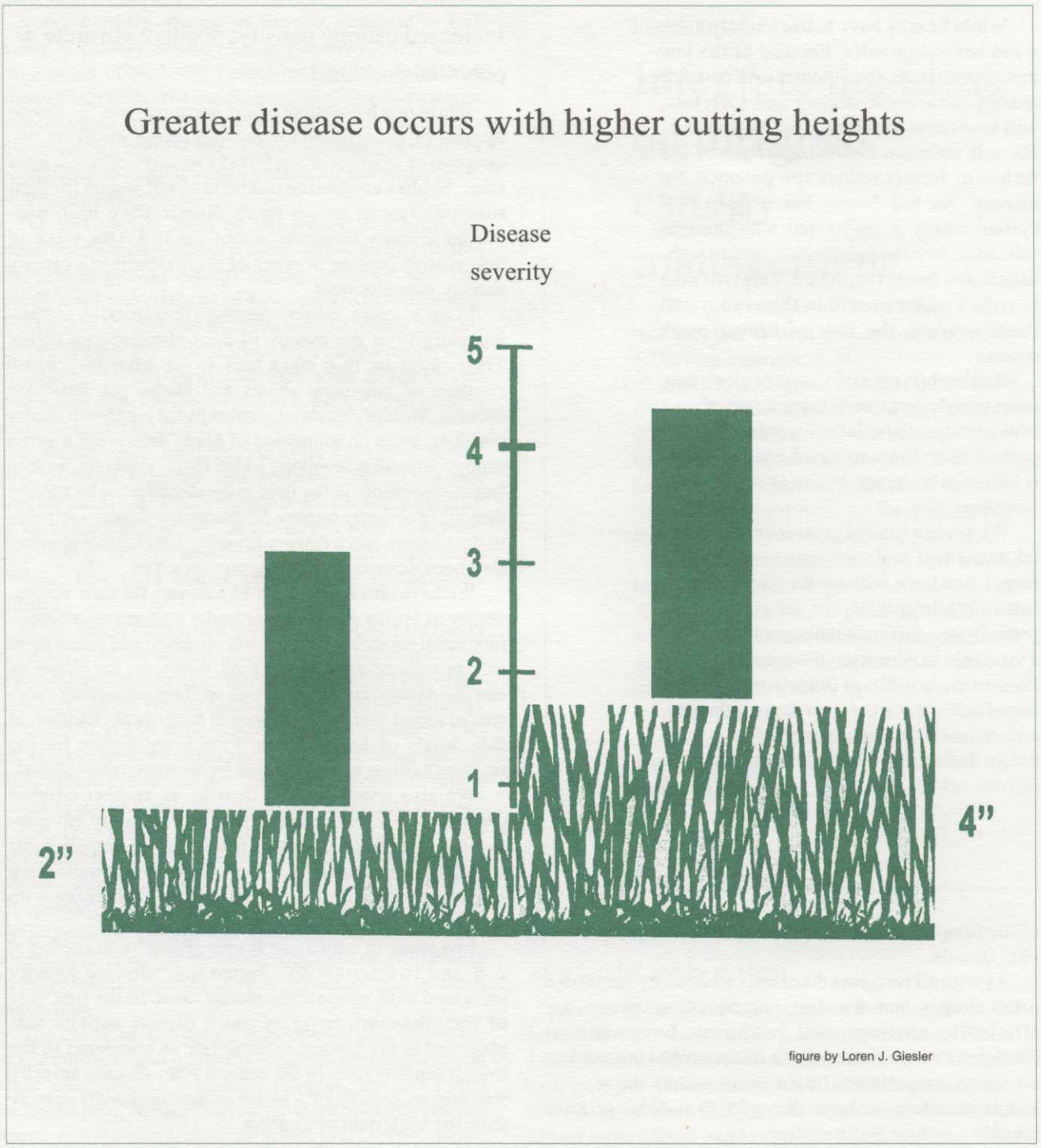
While he may have to use slightly more weed control initially, because of the low grass population, the outcome will be a full canopy with lower density and therefore, will have reduced potential for brown patch. He will maintain a mowing height of 2.5 inches to further reduce the potential for disease. As tall fescue has a deep root system which is associated with drought tolerance, he can apply deep watering techniques at a lower frequency. This will help to reduce moisture within the canopy and further reduce the risk of brown patch disease.

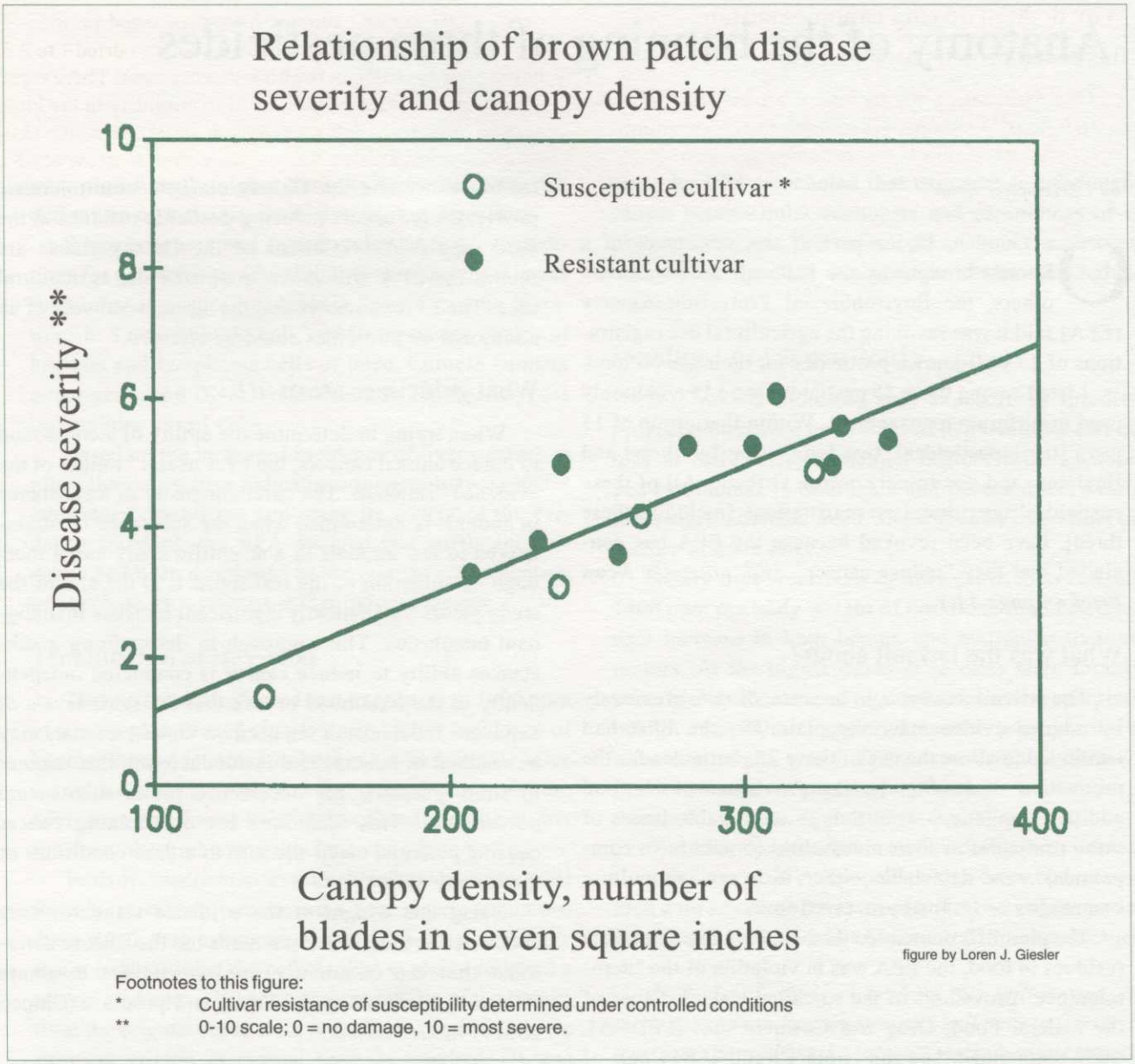
While this scenario is a logical one, most people want something better than a low-density, coarse lawn. In order for ideas such as these to be accepted and practiced, it will take a change in the attitude of the consumer.

We are in a time of greater environmental awareness and everyone would like a carpet-like lawn without the use of chemicals. While this is not possible at the present time, turfgrass managers could play a vital role in education the consumer public as to the benefits of lower seeding rates, use of cultivars with lower canopy density, and maintaining a moderate to low cutting height during the height of the brown patch disease season. ■

Why do high density canopies sustain increased brown patch disease?

One explanation for increased brown patch disease in high density canopies is that the micro-environmental conditions within those canopies are more disease-favorable. By measuring conditions within the canopies of low and high density turfs, we have found that high density tall fescue canopies have prolonged periods of moisture (See figure Page 1.) Leaf surfaces dried 1 to 2.5 hours later each day in the high density turfs. There were also more extended periods of high humidity in the high density canopies due to reduced air movement. This gives the brown patch fungus more time to grow across leaf surfaces and to infect tissues. Temperatures were found to be similar for low and high density turfs.





Footnotes to this figure:

* Cultivar resistance of susceptibility determined under controlled conditions

** 0-10 scale; 0 = no damage, 10 = most severe.

Another way in which high density turfs affect disease development is by increasing the potential for spread of the brown patch fungus within the canopy. *Rhizoctonia solani* is limited to spreading by hyphal growth or dispersal of infected grass blades through mowing. The fungus does not produce spores and therefore, does not spread by serial means. Growth through the canopy is limited by the proximity of healthy leaf blades surrounding a leaf blade infected with the fungus or merely harboring the fungus on its surface. We observed the brown patch fungus to spread from leaf blade to leaf blade or from plant to plant more rapidly in high density turfs because deaf blades are closer together.

Increased cutting height; positive attribute or potential problem?

The common recommendation, in regards to mowing height, is to increase cutting heights during portions of the year when the turf in under stress. For tall fescue, this is in the hot mid-summer months, also during which the brown patch fungus is most active. By increasing cutting heights at this time, the turf canopy environment is caused to be more disease-favorable. The figure on page 4 shows the effect of cutting height on brown patch disease. This effect has been shown not only in our research, but also has been reported at many other locations. ■