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## Some Ideas about Roots

Dr. W.H. Daniel, Purdue University  
July 1979

### Introduction:

1. What is a root?
2. Where are the roots?
3. Roots are plant membranes
4. What is water-air balance for roots?
5. Roots are strong
6. How would you insult roots?
7. What could you do to favor roots?

### Conclusion

#### Roots - Turfwise

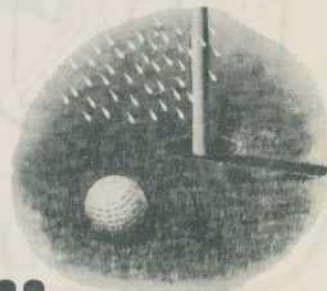
Our historical roots, as a family and individuals, have recently received special attention. However, the roots of concern in turf are those little white stringly things that supposedly are below the grass you see on the surface.

**First, what is a root?** Roots are initiated at the nodes occurring along stems. These may be concentrated in a crown or spread along a stolon. Portions of mature roots are mainly conductive tissue plus providing some storage of nutrients, especially starches.

The working part of any root is the soft absorptive root tip and the root hairs near it. This is where the payload of water and elements are absorbed for transfer to the crown, stems, and leaves known as the turf cover. And, woe is the plant which had **lost** its root tips! So, a living root is that plant tissue joined to the node and extending to and including a root cap. Although some branching is normal, when individual root tips dies, the older root parts seldom initiate new root tips. Physiologically the plant's response is to initiate a new root at the node and just start again (provided extra energy is available and time is allowed). In other words, the energy path is to start a new root, which has least transfer distance for nutrients. So, keeping root tips alive and active is the first challenge of turf managers.

Bud Esterline at Muncie one time said, "Bill, on Monday I cut the cups and could see roots about five inches deep. It was so dry, so Monday evening we made a big effort to water the greens real good. Tuesday morning early it rained and it was so cloudy and wet that we couldn't mow Tuesday. Although still raining, we finally mowed a little Wednesday

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afternoon, and the rain just set in there. Brown patch began to show. We finally got our greens mowed on Friday, and on Saturday the weather cleared up and all I had for roots were a few black strings! I lost my complete root system between Monday night and Saturday morning." Now what? Bud knew he had to lightly water those greens, to watch for wet wilt, to keep the leaves moist enough so they wouldn't wilt until new roots would generate. If he could get by for



about seven days he'd have some new roots growing, and later some good roots working again, and back to normal. Five days of wet weather cost Bud his root system, and then it took him ten days to get partial replacement.

**Where are the roots?** Would you believe 90 percent of root length is in the upper two inches or 5 cm. In West Germany my friend, Dr. Boecker, reported extensive testing.

Roots		
inches	cm	%
0-2	0-5	90
4	-10	5
6	-15	3
	below	2

Boecker found 81 to 91% for fescue  
86 to 94% for bluegrass  
85 to 93% for bentgrass  
Root distribution in June and December were near equal.

Don't fret over this distribution; just realize that it is the active root tips doing the work.

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Ideally, a diffuse extensive root system is desired, but for every use, management, rootzone and irrigation, what is normal, adequate and necessary will vary. As turf managers, you want all the roots possible or practical.

Roots have been found over 100 inches long under Bermuda in California tests. However, roots of three feet for fescue and zoysia, 2 feet for bluegrass and bentgrass would be considered quite long. When trenches are made across roughs or tall grass areas the long root extension in the soil profile is usually impressive.

**Roots are plant membranes.** "Here, you root; do this! Absorb (take in) 5000 pounds of water plus one pound of elements the plants must have. By the way, **keep out the excessive and avoid the unneeded.** Meanwhile, let's hope nematodes make no holes, and rhizoctonia doesn't infect. And, while you're constantly expanding, we'll try to keep the leaves healthy, the mower sharp, the wear distributed, the drouth averted, and we'll try to avoid scalping or other turf stress." After all, the top must send energy clear down to the root tip. When energy is short the number

of root hairs diminishes, the diameter reduces and the root initiation slows.

Roots are powerful absorbers. Before the plant wilts roots will take water from soils down to 13.6 atmospheres, a pF of 4.5 or tension equivalent to 14 meters of water. The wise turf manager has every reason to utilize the reservoir of moisture within a rootzone between irrigations. In other words, it is foolish to ignore the rootzone moisture storage potential when managing fine turf.

**What is water-air balance for roots?** Incidentally that root tip must have some oxygen as it works. Waterlogged soils are hard on roots. Being waterlogged for more than 24 hours under stress weather is a cause for concern. Most turf managers have seen roots growing over the surface of the ground in an attempt to be where there is air. Roots may be deep or shallow just in response to air supply. We've seen roots grown in water when air is added, but remember, oxygen travels through water 1000 times faster than through wet compacted soils.

**Roots are strong!** When roots are numerous their combined strength is in athletic fields, tees and traffic areas. New roots in new soils always look good. A measure of success is to have sufficient roots to hold the soil mass for their entire depth of penetration when held by the surface sod.

Research on rooting of sods has been conducted to determine resistance to an upward pull after one month of growth.

**How would you insult roots?**

1. Reduce the air at root tips.
2. Increase the water to excess
3. Compact the soil; use equipment and carts
4. Smear, seal the surface.
5. Raise the temperature
6. Overcrowd the plants
7. Lose leaves to diseases; lose energy
8. Reduce leaf surface
9. Shade by trees, buildings, other plants
10. Overfertilize and stress plants

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### What would you do to favor roots?

1. Increase oxygen in rootzone
2. Avoid any overwatering or continued wetness
3. Vertically core, spike, slit open rootzone surface
4. Topdress to raise cutting height
5. Topdress to minimize surface compaction and effect of thatch.
6. Increase leaf surface
7. Avoid or spread wear
8. Avoid disease or turf weakening
9. Lower the temperature - cooling when possible
10. Reduce shade or competition
1. Fertilize - low to medium nitrogen.
12. Provide ample potassium and minor elements

Turf managers and their crews can't make a root!  
You can help; let the plants make them. You can kill  
the root or slow it down.

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