ROLLING RESEARCH & FINDINGS, FEBRUARY 2002

Tru-Turf RS48 Roller @ M.S.U. Field Day

Topic: Lightweight rolling not just for green speed

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Welcome to Orlando. I'm very happy to be here today and honoured to share some things with you.

I spent some time walking around the trade show and in doing so I stopped by and looked at the green rolling literature. Amongst some of the claims I found the green roller people saying was that turf can handle high heat and dryness better if you roll your greens and it also resists disease better if you roll. I thought to myself if I hadn't spent the last eight (8) summers doing lightweight green rolling research I wouldn't believe any of these claims. I would think "Yeah! Right" because I'm pretty sceptical that way. But I am going to show you that indeed some of these claims are true and we'll see if we can make the pieces of the puzzle fit together.

It was around 100 years ago the debate about the frequency and weight of rollers began to be debated. In 1901, Walter Travers wrote the book "Practical Golf" and lightweight rolling back then he thought you should roll daily with a light roller. But exactly what was a light roller it really wasn't defined until 1906 when Horace Hutchinson, who was a greens keeper said that a light weight roller should be 3 feet or so in width and should weigh between a hundredweight and a hundredweight and one half. A hundredweight is actually 112lbs so it should weight between 112 and 168lbs.

Later, Piper and Oakley got into the act – they were early turf grass research pioneers and thought than, that frequent rolling is better if you roll light rather than an occasional heavy rolling. They pointed out that it was probably impossible to roll too often on sandy soil. However, there were still many people who thought that rolling did damage to the turf, and somewhere in the mid-twenties research was conducted and they began for the first time to understand that compacted soil was bad for the turf, although no research with rollers had been done. Although it was believed that rolling caused compaction contrary to proof of that – so there was this sort of assumption made and for that reason rolling kind of disappeared for a while in the early part of the 20th century.

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Now in the late 1980's – 1990's because of the requirement for extra green speed we began to see the lightweight roller's return once again, but there was again some caution. Many superintendents reported there use for tournament play only and should be restricted to maybe once a week. So we went into these trials with a lot of caution, which is probably a good way to do things such as this.

I've done two main studies over an eight year period on greens rollers and I'm also going to mention some research that was done at Penn State University, in North Carolina, to see how it all fits together, but for the main part I am going to talk about a study I performed using three different green construction methods and we will also look at their physical properties.

The three different soil construction methods are – the USGA standard – which was an 85% sand 15% peat mixture. We also had an 80% sand, 10% peat, 10% soil mixture and then a native or push up sandy clay/loam soil. There are three applications for each of these soil blocks. Each of the greens were 40' x 40' with a watering tower at the corner so that we could control the irrigation. In 1995 I split these greens basically in half to make it so I could roll one half of them and the other half would not be rolled within the same irrigation block, they all received the same moisture which is going to be very important as we go along.
In 1997 the USGA decided to get involved and thankfully they came and helped fund this study.

We also put some nitrogen and potassium treatments on top of these rolled and not rolled greens. I'm not going to go into that very much today but it's worth a mention because you also see one or two of these slides will have nitrogen data in them as well.

The roller I used was an "O'lathe". So that you know I'm not doing any advertising they are now out of business. It was 3 foot in length and weighed 940lbs, which by today's standards is a pretty heavy lightweight roller. I would imagine one of the reasons it didn't stick around was that the transport method was slow and it was heavy. Today's models seem to be a bit quicker, lighter and easier to operate.

Very, very, very, important. These plots were mowed early in the morning, I spent 4 years working on a golf course, so I'm used to getting up at the crack of dawn and I would go in at sunrise mow the greens pretty much like I would imagine most of you do and then within an hour after these greens were mowed they would be rolled. Another very important point is we rolled three times a week and another really important point, we sand top dressed them bi/tri-weekly which means every 2-3 weeks, depending upon the environmental conditions and how fast the turf was growing.
Another research done in the 1990's looked at roller frequency research. Green speed was what we were looking at and the damage to the turf. Penn State had plots rolled zero times, one and two times a week and among their findings was that if you rolled at these increments and frequencies you didn't cause any damage to the turf or any increase in compaction.

At Michigan State the studies I performed zero to three times a week we also found no increase in compaction. In North Carolina State, zero and one times again, no increase in compaction, no decrease in quality, but once you got up to four and seven times a week at North Carolina State they began to notice that you could see some decrease in turf quality and in one of the two years of the study they saw an increase in the bulk density.

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Another thing we talk about is green speed, and we all agreed that the day you roll the plots you increase the green speed 8% - 16% and the day after what remains is a 3% - 8% increase in that green speed. What this means in numbers is a 1 foot increase the day you roll and 6" of that 1 foot remaining the day after. Now exactly what that meant we wanted to do some more studies and through the years I have done 3 or 4 different green speed perception studies at field days at Michigan State University and we'll look at some of the data to see what that 1 foot or 6 inches remaining means to us. For this study we had two different mowing heights and basically the golfers were asked, is this green faster or slower and we created greens that were 1 foot faster at a 0.186 mowing height and created greens that were 1 foot faster at 5/32" mowing height, we did it the same with a 6 inch difference at those different heights and one of the things I want you to note here is that the 6" difference in green speed of both of these mowing heights 50% of the golfers couldn't, tell the difference, because if you think about the question the question was "Which of these two greens if faster?" 50% of them came up with the 6 inch difference, 50% means you can't tell. Now once we got it to 1 foot in difference, golfers could tell the difference and when we were at the mowing height of 0.186 over 80% could tell the increase in green speed. I like to sometimes think of extremes. If I have a green that is stimping at three and I compare it to one stimping at four, certainly everyone is going to be able to tell the difference between those two speeds, but if I have one that stimps at 20 and the other one is stimping at 21, the chances of noticing that 1 foot difference diminishes.

Let's look at data from 1995 and 1996 from my plot and the way that we rolled both years, we averaged a 1 foot increase on the day we rolled, 30 hours after rolling or the next day we had that 6" increase remaining. Now that's a very interesting number. Because if a golfer cannot tell the difference of a 6" increase that means they cannot tell the difference in a 6" decrease, doesn't it? So I like to look at this glass a being half full instead of half empty which means that if a rolling frequency of three times a week can allow us to have increased green speed over non-rolled greens 6 days a week.

Another thing, I would really like to point out that 50 plus hours after rolling you see about 4" difference. That's not very good. Now, we've dropped quite a bit of inches off, so every other day or 3 times a week seems to be a nice frequency and I really want to point out when you roll your greens send your guys out there with the rollers, ensure they roll after the mowers have cut the greens. If you stay on a programme where the rollers keep beating the mowers you are not going to get the increase in green speed that you might desire. So it is actually pretty important that we mow before we roll.

So as I say three is the magic frequencies for us to find no increases in bulk density, we've found no decrease in turf grass quality and as I say we can increase the green speed six days per week.

In 1994 Dr James Beard pointed out that we really need to look at continual season long turf rolling because of the possibility of increasing disease and I really would have thought that sure dollar spot is one of those diseases most of us in this room immediately think of Dollar Spot, how is it transported, well basically mechanical means we're told that we carry it on our mowers, we carry it on our feet, we are carrying it from location to location so we are helping spread it. So it just makes sense that a roller would increase the amount of dollar spot you would see. So in 1995 I started counting the amount of Dollar Spot that I could find on each green. The rolled greens was where I started to see less Dollar Spot. Not at all what I was thinking I was going to see but this is just one year, so the next year when the Dollar Spot started to show up again, I did some more counts and lo and behold every time I counted it in 1996 there was less Dollar Spot where we rolled. This made no sense to me, sometimes this is the kind of data that you don't want to tell anybody because like I said I am sceptical so I expect most every other person is. So rolling three times a week was definitely giving us less Dollar Spot. The green on the left is a not rolled plot showing around 90% more Dollar Spot and the green on the right that is rolled three times a week showing a huge reduction in Dollar Spot. So why? Theories and that's the key word, theories why the rolling decreased the amount of Dollar Spot. Why, it removes the dew?

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You look at those plots there, and maybe it's pretty easy to notice that some have less dew than others. Now I'm going to point out we mowed before we rolled and you also know that in the morning sometimes you mow those plots and you can come back a half-hour later and the dew's settled hence more moisture again. Therefore a rolling removed the dew what fell afterwards. Also it removes excess leaf litter. When you are mowing that early in the morning, even though you have buckets sometimes all of those clippings do not end up in the bucket, when you roll the roller picks up some of those clippings and takes them back to the wash pad. It could also decrease, the concentrations of guttation water coming out of the leaf, turgid pressure is high in the early morning when we are mowing first thing. We cut the leaf, it allows the guttation to possibly extract and that's a concentration very high in nutrients, the pathogens can use them and that helps to spread disease because they use that guttation water as a source.

What rolling is doing at this time of the day is taking that guttation water and spreading it out enough so that the concentration is thin and isn't as high. It also increases the soil moisture holding capacity. Now we said we never saw an increase in bulk density and in fact over 5 years and two times a year we looked at the physical properties on these plots we never saw a change in the total porosity. However, we did see a slight increase of more water holding capacity on the sandier greens, so not always statistically significant but always an increase or a trend as we would say in the amount of moisture that the sandier soils held, no change in total porosity but an increase in the amount of microspores, so more water holding capacity. And interesting enough a lot of people would think, when I was a superintendent, if I had Dollar Spot one of the things I wanted do was put some nitrogen down, but as Clouch & Bloomer reported some years back, low moisture is important in the development of Dollar Spot maybe possibly more so than nitrogen.

Remember, I told you that we took these plots and we split them for nitrogen differences over time so here we have these three different soils and there are several things that I want you to notice. Now, the box on the left from the USGA, I call it the USGA green that the 85/15 mix, it has the most sand or actually the least soil so the least water holding capacity. Then as we move along we increase the amount of soil and we are seeing that we have less Dollar Spot. OK, so in other words, more moisture holding capacity. Now we notice if we just look at the predominantly sandy green we have plots here, the grey bar is not rolled and it has the low nitrogen content and low and behold it had the most amount of Dollar Spot. The not rolled high nitrogen we see has less Dollar Spot and then after that we get to the rolled plot and we have a lot less Dollar Spot.

As we notice here that given the sandy soil it ends up acting more like the native soil in the amount of diseases it gets. Now this isn't a huge difference and this is just looking at the sandy green and sand rolled is the blue bar the sand and not rolled is the one underneath, we just see a slight increase in the amount of water holding capacity so if we had an increase in water holding capacity we might expect that we'd have less localised Dry Spot and sure enough we do. The green on the left was not rolled and the green on the right was but we found that we had less localised Dry Spot where we we're rolling and this is the data and we see that as we roll each plot again we have less localised Dry Spot than not rolled. The funny thing is Metcalfe, was a superintendent back in 1922 and he wrote for superintendents in the USGA greens directory article - he named the article, "Treatments Kind to Unwatered Greens" and one of his treatments was a way that stopped him from getting localised Dry Spot, and that was to roll the green.

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When we were working on the plot we began to notice that there were bird peckings out there, so I thought I'd go out there and count the amount of bird peckings that were on my green. And I know you are thinking I am physco or something for doing stuff like this but as a researcher we have got to go out and count things so I went out and I counted these plots and what I seemed to find was – where I rolled three times a week I had less bird peckings than where they were not rolled. Where I rolled three times a week in both of these instances in 96 and 2000 there's a reduction of 56%. Well who cares? Well, lets make a connection. I counted those bird peckings when cut worm damage was high in the golf courses around us and what I found was that Dr Carter, a very highly respected entomologist from Kentucky noticed that the cut worms lay their eggs singularly on the tip of the blades of grass and many of the eggs bypass through the mower blades so his point was you have got to take the clippings far off the green. Earlier I made a statement that I thought all those clippings still don't end up in the bucket and possibly they end up on the roller the clippings that don't make the bucket or, in this case, the black cutworm eggs that are on those clippings end up on the roller and back at the wash pad, so we have less cut worm eggs on the green.

Also I just wanted to point out one year, we did weed counts as well and I had less broad leaf weeds where I rolled. The strange connection about that is we can also see from this slide that where I put down 1lb of nitrogen monthly as compared to 1/2lb there were also less weeds. This is what we would expect less weeds if we have more turf density, so the possibility could be that we are actually having a little more turf density when we are rolling three times a week and to fill that in more, one year, 1996 was a very wet year up in East Lansing, Michigan and as a condition of that, I got moss, so we went out and we counted the amount of moss on each green and what we did was I sent two workers out and they looked for anything that was a dime size moss and counted it and what we ended up with was that once again predominantly on the native soils where we had the most moss but we found the not rolled had far more moss than the rolled plots.

So my gosh, I had better come up with a negative to rolling or no one is going to believe me. So lo and behold, one year in 1996, where I rolled I had more microdopien patch than where I did not roll. Now this also goes by another name, it is "Pink Snow Mould". I want you to notice the data on that – 5th June there was a cold year – this isn't so much that I never observed the Pink Snow Mould being increased coming out of the winter, but in any event this is a negative.

So lets wrap up!

(1) Rolling Greens – 3 times per week after early a.m. mowing the greens that were sand topped dressed every 2-3 weeks certainly increased green speed – and I would like to say 6 days a week.
(2) Decreased Dollar Spot symptoms every year of the study.
(3) Decreased Black Cut Worm activity which is a theory I can really only say it decreased the amount of bird peckings.
(4) Decreased localised dry spot.
(5) Decreased broadleaf weed infestation the one year that we had weeds on the plots.
(6) Decreased moss occurrence the one year we had a moss occurrence on the plots.
(7) It did increase microdopian patch (Pink Snow Mould)
(8) Had no negative effect as far as compaction and produced no consistent changes in turf colour or quality.

We are going to look further at this, "Could lighter rollers be used?" I used one that was approximately 1000lbs, they are on the market weighing about 500lbs and if I know that I'm in a really heavy Dollar Spot or cut worm area maybe I'd raise my rolling more – we are going to look at that, but to sum up I agree with Harben from 1922 – that I do not believe rolling is a mere fad and I think this holds a lot of potential for all of you in the future, and I'd like to thank the United States Golf Association for funding five years of this study. I hope you enjoyed this and find it beneficial. Thank you very much.

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