Turfgrass Fundamentals

Slide 1

This is Doctor Gwen K. Stahnke, Extension Turfgrass Specialist, Washington State University Puyallup. We are going to be going over fundamentals of turfgrass management for Washington State. We will first discuss some basics of turfgrasses and soils to make sure we have the proper background for information we will present as we get further into the program.

Slide 2

Here is an average homeowner's yard featuring turfgrass; it gives a nice smooth green effect around the home. Turfgrass provides many benefits for the environment, including a cool effect around the house, erosion control, water infiltration, and it ties all the elements of the landscape together. Furthermore it provides a smooth, firm living surface for kids and adults to play on that will take the wear without becoming a mud hole. This presentation will give you the knowledge to grow and manage healthy lawns for use by homeowners and other public use areas.

Slide 3

We can't talk about a healthy turf area without talking about the soil it is grown in. A good soil will promote a healthy root system.

Slide 4

This diagram shows the comparison of soil texture types of clay, silt and sand. There is a red arrow going from the bottom to the top of the screen. The direction of the arrow indicates the increase of the properties on the right hand side of the arrow. At the very top of the screen is clay; clay exhibits the highest compaction, highest moisture retention, and the highest nutrient holding capacity. Conversely, sand has the lowest compaction tendency, lowest moisture retention, and the lowest nutrient holding capacity.

Slide 5

An ideal soil for turfgrass should be a twelve-inch depth of a sandy loam. If we go back to the previous slide on soils, this soil texture would fit somewhere between the sand and the silt. We can get by with six inches of a rooting medium over a gravelly base to foster adequate drainage. However, we need to be careful not to create a perched water table over the gravel. A perched water table occurs if you change the textures of the soil very rapidly. The water will sit at the interface of those two soil layers until the hydraulic head builds up high enough for the water to move downward. Creating a water-saturated soil in a shallow six inches or less root zone would essentially drown the turfgrass roots due to lack of oxygen.
Slide 6

This diagram compares the three components of soil, pore spaces and the solids in a normal, compacted, and poorly drained soil. Normal soil exhibits fifty percent solids and fifty percent pore space, with half of that pore space in air and half in water. The two most common problem-type situations found in turf are compacted and poorly drained areas. In a compacted soil we lose much of the oxygen or air space by heavy traffic over that site. In other words, the pores have been squashed and not having any room for gasses like oxygen. The percent pore space holding water will still remain. If we look at a poorly drained soil we again lose pore space that has air in it, but this time it fills up with water instead of being compacted into solids. So we still have fifty percent solids, the increasing percent water, and losing oxygen. In short, both compacted and poorly drained soils exhibit a lack of oxygen in the soil environment, therefore, the turfgrass will not develop a healthy root system and something must be done to improve air circulation in the soil.

Slide 7

This table on water availability shows the amount of water that is available, in inches, in a six-inch depth of each of the soil types listed: course sand, medium sand, fine sand, and sandy loam. If you will notice, a course sand will only have one-quarter inch of water available to plants in comparison to a sandy loam, which we said was the ideal soil type for growing turf, and that soil will have an inch and a quarter of water available to plants. This is a big difference and a very important fact when considering irrigation scheduling, especially in the three months of the year where we do not have adequate rainfall. If we look at water use for the turfgrass west of the Cascades in our hot dry months of July through September, we usually lose about twelve-hundredths of an inch of water per day. Hence, about an inch of water per week, so this should be enough to keep turfgrass healthy, and this is about eighty percent of evapotranspiration or ET. Under these conditions, a coarse sand would have approximately a two-day supply of water for turfgrass, where with a sandy loam we should be able to water on a much less frequent basis. East of the Cascades, turfgrass may lose three-tenths to a half-inch of water per day from July through September, making this information on how much water is available even more critical.

Slide 8

When we talk about a normal site, we would like to get by with using surface drainage or a nice one to two percent slope off the site away from buildings for our drainage. But in some of our conditions, a heavier soil such as clay will prevent the necessary infiltration. Under these conditions, subsurface or tile drainage is often required. Normally, tile drains are placed at least sixteen inches below the soil surface. On a normal homeowner's site, the average diameter for a drainage line is four inches. A turfgrass root zone ideally needs at least twelve inches of a root zone depth, and if we add the four-inch diameter of the drain line to the root zone depth you get the sixteen inches below the surface. Average spacing is usually ten to fifteen feet on center and there is usually gravel put in the base of the trench. The drain tile is laid into the trench and a couple inches of gravel is laid over the tile. The remaining area of the trench is filled to the surface with topsoil that will drain adequately. For very heavy clay soils, it is very
important not to fill up the trenches with the same soil, as it will not allow the moisture to get down into the drain line to allow it to be effective.

**Slide 9**

To establish a baseline for soil nutrients, performing a soil test is a very good idea. It gives the phosphorous, potassium, calcium and magnesium levels of the soil as well as the pH and organic matter. We do not usually test for nitrogen because it is a very mobile element. One main reason to conduct a soil test before planting grass is that phosphorous and lime or calcium should be worked into the soil before planting occurs. Nitrogen and potassium are fairly soluble elements, so they can be added to the surface while the grass becomes established. Without a soil test, there is a general rule-of-thumb we can use: apply one pound of nitrogen per thousand square feet of a starter fertilizer. The starter fertilizer should have approximately equal amounts of the three elements listed on the fertilizer bag: nitrogen, phosphorous and potassium. Using starter fertilizer is appropriate only during the establishment or overseeding of grasses. We can limit the amount of phosphorous applied for maintenance purposes.

If you want to calculate how much of a product it is going to take to get one pound of nitrogen per thousand square feet, all you need to do is find the first number on the label; for example, ten for ten percent nitrogen, then pretend you have a hundred pound bag of fertilizer. So if we divide ten into one hundred our answer will be ten pounds of nitrogen, so it would take ten pounds of this particular fertilizer to give us one pound of nitrogen per thousand square feet. We can do that with any fertilizer product. Let's take another example, ammonium sulfate, which is twenty-one percent nitrogen. If we divide twenty-one into one hundred you come out with a number that is slightly less then five, approximately 4.75. Therefore, it will take 4.75 pounds of ammonium sulfate to provide one pound of nitrogen per thousand square feet. Using that calculation, we can figure out how much fertilizer product we should use to cover an area.

**Slide 10**

We’ll move along to surface preparation, which is one of the most important factions to look at. If we have had a lot of large machinery going over the site, we need to make sure to alleviate the compaction that machinery may have caused. We cannot expect to establish sod or new grass from seed on a surface that's as hard as concrete; the roots will not penetrate that soil. We must rototill these compacted areas and make a nice final grade, preferably one to two percent slope away from the building. Next, we need to roll it, not using a steam roller, rather rolling with a landscape roller filled about halfway to two-thirds of the way with water. When finished rolling, walk across the surface. Your feet should only sink in about a half-inch. Finally, rake the site and smooth it out so that you have a nice surface for either laying down sod or spreading seed over the surface. This is the one area where we cannot take any shortcuts. If we do take shortcuts at this stage, the turf will not become healthy, which results in increased maintenance efforts in the future.

**Slide 11**

The seed size for each species of turf is different, so the seeding rates are also going to
be different. The largest seed that we use in the western Washington area would be tall fescue and that should be seeded at eight to ten pounds per thousand square feet. On the other hand, our smallest seed would probably be in the bentgrass group, seeded at one to two pounds per thousand square feet. When we seed the site we calibrate our spreader for half the intended rate and then we will seed it in two perpendicular directions so we can cover the whole site. If we miss a spot going in one direction we will pick up that spot going the other way. After spreading the seed we should lightly rake it and roll it. Rolling is very important to get good seed to soil contact. Sod should also be rolled so we don't have any air gaps underneath that sod. And finally we can irrigate the area.

Slide 12

Let's go on to look at seeding rates for home lawns and this time we'll look for west of the Cascades. Notice that perennial ryegrass is seeded at about five pounds per thousand square feet. When we mix it with other types of grass such as fine fescue, red, hard, or Chewings fescue, we reduce the perennial ryegrass content and add in perhaps two pounds of the fine fescue, which has more shade tolerance than does the perennial ryegrass. The seed mixes that are sold here in the Northwest are made up of grasses that will flourish and have different characteristics that will help them survive in that particular environment. For example, the perennial ryegrass is a very wear tolerant grass and serves as a reliable full sun grass. The fine fescues are shade tolerant and don't usually take a lot of wear. So, if we put the two together in a mix, we should be able to keep turf over the entire area even though the conditions may vary substantially from one end of the area to the other. There is not one ideal seed type for the Pacific Northwest.

Slide 13

Here you see the seeding rates for home lawns east of the Cascades. And pretty much on a regular basis anywhere east of the Cascades you will have a Kentucky bluegrass lawn. Kentucky bluegrass is usually planted at three pounds per thousand square feet. It's a very wear tolerant grass, will exist in higher pHs, and actually reproduces by underground lateral stems or stolons, which gives it a very high wear tolerance on sport fields. It is a full-sun grass; you can see on the second line of this slide that very often Kentucky bluegrass is mixed with perennial ryegrass to give an even surface and something that will fill in quickly. Again, if we have an area with some shade we would mix Kentucky bluegrass with a red, hard, or Chewings fescue. And as you see I didn't mention in the last slide, but Chewings is capitalized on fescue because the Chewings fescues are named after a Mr. Chewings out of New Zealand. So it has nothing to do with rabbits or sheep or anything else, it's actually named after Mr. Chewings, so Chewings fescue should always be capitalized. And again, if we have an area that is very sandy, shady, that we don't want to really put much effort into, the fine fescues - creeping, Chewings, or hard fescues - are what should be planted on that site.

Slide 14

In order to make sure you get the best weed-free seed possible, it is recommended that you purchase certified seed or seed with a blue tag. If it doesn't say on the label what
cultivated variety the grass is, that means they don’t know and don’t have to tell you what is in the seed. The less expensive the seed is the poorer the quality, generally.

**Slide 15**

This is an improved turf-type Kentucky bluegrass cultivar by the name of Julius. This would be an example of one of the cultivars that we would evaluate on a monthly basis for five years in a National Turfgrass Evaluation Program, or NTEP study. The data from these trials, which are established all over the United States, is listed on their website which is "www.ntep.org" for all the locations, in order that growers can see which cultivars have performed the best in their local areas.

**Slide 16**

This particular picture is an example of a seed tag on an experimental variety that our research program might plant in order to evaluate a cultivar more thoroughly as it is pending approval. You can see the seed is certified and it has a lot number so that it can be traced back if there is a problem with this seed.

**Slide 17**

This is a handwritten seed tag example: notice the name of the grass with the Latin name and lot number on the next line. The weight of the seed sample is given as well as the point of origin. It also gives the year it was grown and the percent purity, which in this case is 94% of the seed. The germination percentage is only 37% on this seed sample, which says it was tested on August 27, 1991.

**Slide 18**

For grass establishment there really isn’t any difference between seeding or sodding; the principles are constant. It is very important to keep the surface moist, so water frequently and shallowly to keep the new little plants or seeds hydrated. After several weeks, when the roots become established, we should reduce the irrigation frequency and start watering more deeply. Water deeply and infrequently to help pull those roots deeper into the soil. If we continue to water shallower and frequently, that’s exactly where the roots will stay, up in the upper surface and they will go no deeper into the soil. For some sites with heavier soils this may mean watering in several cycles in one day and then waiting two or three days to water.

**Slide 19**

Fertilization is desirable after plants have emerged, or after sod has been laid. However, if a pre-plant fertilizer was applied, we usually do not need to re-fertilize that area for about six weeks after planting. The exception to that rule is if we put the sod or seed on a very sandy site and used a quickly available product, it may require the application of a soluble fertilizer in about three to four weeks. For best results, we should use no greater than half a pound of soluble nitrogen per thousand square feet during establishment. We need to be especially careful of nutrients moving off the site during plant establishment. At this time, there is not a fibrous root system established yet to take up
the nutrients from the fertilizer as quickly as it will later on. After the grass is established, it will probably take up any fertilizer we put on the turf, within reason. Within reason means no more than half a pound of available nitrogen per one application. Another item to think of, keep the product off the sidewalks and out of the street. If fertilizer is applied off of the targeted turfgrass area, sweep it into the turf or sweep it up immediately. Any fertilizer on the street or sidewalk, if water or rainfall comes, could be washed directly into the storm sewer. Sweep up any fertilizer that goes off target onto hard surfaces. Research has shown that fertilizer on the turfgrass area will take about six inches of rainfall in a half-hour to move anything from the site, so fertilizer on the turfgrass area is not the problem.

Slide 20

Before we select turf for the area, whether it be seed or sod, we need to determine what the qualities of the site are. Does it have shade, sun, or some of both? We should also determine if it is properly drained. We don't have very many grasses that will tolerate saturated soil, so drainage should be corrected before the grass is planted. Will the grass be used for four or five soccer games a week, or will it be only occasionally used in a backyard by a family?

Slide 21

This section will get us acquainted with the different types of grasses.

Slide 22

When we get to home lawns, they are usually a mixture of five or six different grasses. Right here where the pointer is is a Kentucky bluegrass, and as I move this marker a little bit, here we can actually see some seedheads. And where we see these seedheads; that is actually annual bluegrass coming in. And we've actually got over here some perennial ryegrass. And we've actually got a lot of annual bluegrass. Follow my marker to the left - see this yellow green grass, this is annual bluegrass, as it comes in it's a native grass that's everywhere. OK, we've moved a little bit here because we have a big patch of bentgrass here - it's probably a colonial type - and you can see it's laying over. As I run my hands through this, you'll see that it comes up longer even though it's been mowed. When you take a rotary mower over it, it just pushes it down. And that's why, when you look at a bentgrass lawn, it should be mowed shorter then your average home lawn, as we're on the west side we're mowing it two, two-and-a-half inches, on the east side three-and-a-half inches. And a bentgrass, because it creeps by stolons, needs to be cut at about an inch-and-a-half with a reel-type mower. You can use a rotary, but you'll tend to scalp. You can see the difference, and this is one thing that homeowners get upset about, you'll find it very frequently in home lawns, that bent grass will become an invasive weed or on the west side that's what they have in their lawn. And it's a very drought-tolerant grass, but you see if you go over it quickly, if it's wet in the morning when you're mowing, it's going to push over like this and you are going to end up with a lot of long straggly runners.
Kentucky bluegrass is the first grass that we’re going over, and it should be used as part of a mixture in our turfgrass seed mixtures in western Washington. If you are in eastern Washington or any other northern site, Kentucky bluegrass is a good choice due to its tolerance of wear and other characteristics. We use it as part of a mixture in Western Washington because it produces underground lateral stems, or rhizomes, which will help give a more stable surface. It is predominately a full-sun grass with some cultivars being better adapted to shade. However, it does not do well without a period of dormancy in western Washington, and in January and February it becomes susceptible to invasion by moss and annual bluegrass due to the slow growth from partial dormancy and infection with leaf spot or Drechslera poae. Nonetheless, there are about twelve different cultivars of Kentucky bluegrass that we can use in mixtures with perennial ryegrasses. Rhizome production by the Kentucky bluegrass means that there will be more vegetative matter and a greater tendency to produce thatch. However, Kentucky bluegrass is a moderately drought tolerant grass and on the east side of the Cascades, Necrotic Ring Spot, or NRS is one of the few diseases that you will have difficulties with on that side of the mountains.

So, where you see that stake over there is primarily Kentucky bluegrass. And I'm talking about this because on the west side of the mountains we only plant about twelve different improved cultivars of Kentucky bluegrass as part of a mixture because it does hold the turf down, gives us more wear tolerance. On the east side we predominately use the Kentucky bluegrasses. If you look to the left of the arrow, you'll see a lot more of the yellow-green grasses, and that's a mixture of mostly annual bluegrass, which you can see there are some seedheads over in this area. And you can see the Kentucky bluegrass over here - it's thinned out a little bit with annual bluegrass coming in - and bentgrass as well. And in the back you can see a bit of the Deschampsia, tufted hair grass and it has a lot of Poa anna, annual bluegrass, coming in because it's on the edge of the plots where we did not get it to establish as quickly. So it's a difference in competition. If the grass fills in quickly, there won't be much annual bluegrass. If it does not fill in quickly we'll have a lot more annual bluegrass because it's a native grass.

Our next grass we are going to cover is perennial ryegrass.

Turf-type perennial ryegrass is the major grass that we plant in areas west of the Cascades. We plant it because it germinates very rapidly and often out-competes annual bluegrass in addition to being wear tolerant. It is a bunch-type grass, so it doesn't produce runners and it gives a very low thatching tendency. It blends very well with other grasses, such as Kentucky bluegrass and any of the fine fescues. It is a medium-to-high-fertility grass due to its extreme wear tolerance. So, perennial ryegrass, which is susceptible to red thread, will typically become less of a victim to red thread if
it's maintained at the appropriate fertility level. Red thread is a disease of low fertility. For the most part, it is recommended to fertilize the grass so it will grow out of the situation. Fungicides are not recommended for use by homeowners on red thread - it will not kill the grass. East of the Cascades, perennial ryegrass can be susceptible to cold injury and eventual loss of the grass.

Slide 28

Fine fescue is another cool season grass that we use in the state of Washington.

Slide 29

Fine fescues - and when we talk about fine fescues we are talking about creeping, Chewings, and hard fescues - they are a very shade-tolerant grass. Furthermore, if we had a very sandy area that we did not want to maintain very often - in other words don't fertilize, mow, or water very much - this would be an excellent choice. It is very low maintenance, but it also has a very low tolerance for wear. It is one of the most drought-tolerant grasses we have; of course, water is still necessary to help the grass become established. On the other hand, the fine fescues do not like wet soils or wet feet, they do not like to sit in water over the winter season, so they might have a tendency to thin out. Again, this is a bunch-type grass. Because the leaves of the fescues contain a lot of lignin, the leaf tissue does not break down very quickly. This can actually cause a higher degree of thatch within the fine fescue plants, which has the potential to become a problem. If fescues are over-fertilized and over-watered, they can become very thatchy.

Slide 30

This is a research plot where we are actually evaluating different fine fescue cultivars as part of the National Turfgrass Evaluation Program, or NTEP. This is one of sixteen plots throughout the country and this, again, was planted just under three weeks ago. As you can see, there are different kinds of fine fescues: Chewings, a hard fescue, and actually the red fescue and they will develop at different rates. You can see there are a few weeds in here. But this is actually on a sand base, it is actually modified with five percent axis, which is a calcitic clay type - and we also have five percent peat moss in here as well. And this is going to be studied as part of a drought study with the fine fescues to see how far we can draw them down as far as actual limiting of water on this site.

Slide 31

This is a picture of turf-type tall fescue.

Slide 32

Turf-type tall fescue is adapted to moderately wet areas. It became very popular, when we had the so-called drought of '92 on the west side, as a grass that could be planted to avoid the drought. Tall fescue avoids drought by growing a very deep root system, which is good if you have a deep soil for root establishment. If you only have two inches of soil for a root zone the roots will not develop very deeply and will not solve the
problem of lack of water. Tall fescue does have moderate shade tolerance and a better wear tolerance than the fine fescues. These characteristics fit an area with moderate shade, some moisture, and moderate traffic. Tall fescue is also a bunch-type grass so it must be over-seeded in the spring and fall just like the perennial rye grasses and the fine fescues. Most of the tall fescues will go slightly off-color in the winter due to a disease called net blotch. It will go away with warmer soil temperatures and sunlight. Tall fescues can also be used on oceanfront sands to stabilize the soil with minimum water.

Slide 33

This is Colonial bentgrass and it is actually used for lawns on the west side of the Cascades.

Slide 34

Bentgrasses for home lawns should only be planted as Colonial-type bentgrasses because the Colonials do not have the long, aboveground, lateral stems or stolons like creeping bentgrass does, which is used on golf course greens. Creeping bentgrass should stay on the golf course greens and it does not belong on the home lawn. Creeping bentgrass needs to be mowed down close to an eighth of an inch and requires too much maintenance for a normal or average homeowner's yard. Colonial bentgrass, as a lawn, should be cut somewhere between a half-inch to three-quarters of an inch with a reel-type mower for the best results because of its dense crown structure and low growth habit. However, Colonial bentgrass can be mowed at an inch-and-a-half with a rotary-type mower, since mowing with a rotary motor at one inch will cause a great deal of scalping. There will be more thatch if the bentgrass is mowed this high, but many people do have the old bentgrass lawns and do also have a rotary mower. Bentgrasses can be a fairly high maintenance grass if the area must be de-thatched on a yearly basis. Also, with higher fertility the bentgrass can be susceptible to red thread, Fusarium patch, take-all patch, and other fungal diseases. On the other hand, they can also be fairly low-maintenance. If they are thatched on a regular basis, they can be allowed to go dormant in the summer. When the rainfall comes, they then green up on their own without much damage. This assumes, however, there will not be much traffic or wear on the dormant grass. Traffic on a dormant grass will damage the crown or growing point of the plant and it may kill the grass plant. In eastern Washington, bentgrass is one of the most common weeds we have in Kentucky bluegrass lots.

Slide 35
Break Time

Slide 36

We're now going to move on to maintenance practices that are involved with an IPM program for turfgrasses.

Slide 37

The first cultural practice we are going to cover is mowing height. This table shows the mowing heights for grasses both west and east of the Cascade Mountains. Notice that
the bluegrasses, fine fescues, and ryegrasses all fall into the same approximate mowing height category. The grasses on the west side are mowed about an inch shorter than those east of the Cascades due to our higher rainfall and prominence of bentgrass in our mixtures on the west side of the mountains. The tall fescues are mowed at about two inches west of the Cascade Mountains and up to three inches east of the Cascades. Again notice that the bentgrasses, specifically colonial bentgrass, is only recommended for home lawns west of the Cascades. In looking at the mowing heights the lower height is the sport field height; the higher mowing height is the home lawn mowing height.

**Slide 38**

This is an example of a rotary mower that the average homeowner might use. This type of mower is good for mulching clippings back into the lawn, or recycling clippings. The advantage to the rotary mower is that it will mow down the flower stalks or seed heads, whereas the reel-type mower will not.

**Slide 39**

Let’s move on to the mowing specifics. First off, remove no more than 30-40% of the leaf blade at one mowing. This will reduce stress on the plant. Suppose we were mowing at an inch and a half and when the plant reached two inches we would mow it back to an inch and a half. If we let it get too tall we should lower the mowing height gradually. This will help reduce the stress on the plant. You can raise the mower as high as it will go and then drop it back a notch every couple of days so as not to stress the plant. Most people don’t follow that type of a recommendation. Look along the highways and notice that when the sides are mowed very infrequently, the grass becomes quite thin. The best way to thicken up a grass is to mow it on a regular basis. There is no reason not to return grass clippings to the turf if you do not have excessive growth. They will actually break down and put nutrients back into the soil system fairly rapidly. These clippings will provide approximately one quarter of the fertilizer recommended for a moderately maintained lawn, or about one pound of nitrogen per thousand square feet per year assuming you are fertilizing the grass. The clippings will not increase thatch if the lawn is mowed on a normal schedule. One of the best things you can do for lawns is to keep the mower blades sharp to reduce the tearing of the leaf blades, which could increase water loss from the plant as well as make it look bad.

**Slide 40**

Let’s move on to maintenance fertilization for our cool season grasses. Cool season turfgrasses increase their root numbers and depth in the spring and the fall, no matter what you do. Therefore, it is very important to also fertilize at that time. During the summer months the turfgrass roots will become more shallow due to higher soil temperatures. Again, if you are on very sandy soil and use a soluble fertilizer you should break the four one-pound applications into eight one-half pound applications and you should apply them about two to three weeks apart. For a good practical fertilization schedule we can use the holidays as a reminder of when we should fertilize. For western Washington we should fertilize about Easter, Memorial Day, Labor Day, and Thanksgiving. For eastern Washington the holidays are the same: Easter, Memorial Day, and Labor Day, however, the last fertility, the late fall fertilizer, should come at
Halloween, about a month earlier than on the west side of the mountains.

**Slide 41**

This is approximately three-foot-wide drop spreader that is generally used for smaller turfgrass areas for seeding and fertilizing. This smaller spreader can apply fertilizer to narrower areas than a rotary spreader, which applies the fertilizer in a circular fashion. The spreader should be overlapped by at least one wheel width to be sure to get even coverage of the fertilizer or seed over the grass area. Never fill any spreader with fertilizer on the lawn to prevent a dark green spot or a burn area from occurring if you should spill some fertilizer. Again, any fertilizer that might miss the grass and land on a hard surface needs to be cleaned up so that it does not wash directly into surface water or storm sewer when the next rainfall or irrigation occurs.

**Slide 42**

Let's go ahead and look at different sources of nitrogen that might be available to us. This table shows various sources of nitrogen along with the percentage of nitrogen present in each source. The fertilizers with the red asterisk next to them are very soluble fertilizers; they will burn the leaf tissue of the plants if they are not irrigated into the grass. The other fertilizers, such as urea formaldehyde, methylene ureas, sulfur-coated urea and IBDU are slow-release products. The last item listed is Milorganite, which is also a slow-release product, but it is a natural organic source of fertilizer which is dependent on soil temperature and micro-organisms to be available to the plant. The plant does not know the difference between organic and synthetic organic forms of nitrogen. All fertilizers must be broken down into nitrates for the plant to absorb them from the soil solution. Both the synthetic and organic forms of fertilizer may leech if applied incorrectly. The main factor is the amount of nitrogen readily available per application and not the total amount of nitrogen applied at one application. Do not apply an organic fertilizer in the late fall, it will not be available to the plant immediately to give you the growth you need in the fall and it could be leached during the winter months. Remember, pound for pound, an organic fertilizer has a greater percentage of phosphorous than a synthetic product. Therefore, be especially careful if applying an organic fertilizer near a stream or other water source as a precaution against utrification. Better yet, don't apply an organic product near an open water source.

**Slide 43**

This is ammonium sulfate, which is a quick-release product used in very small amounts and applied on a very frequent basis west of the Cascades to help with disease prevention. If one pound of nitrogen is applied, one pound of sulfur is applied at the same time. When a full pound of product is applied in one application, the grass will grow very rapidly and require very frequent mowing. Also, the grass will go yellow in between fertilizations so this fertilizer is not a good choice to use by itself in a fertilizer program.

**Slide 44**

This is a slow-release fertilizer and it's a formulation that could be used in establishment
of a turfgrass area because it has a higher percentage of phosphorous or the number twenty-five in the middle. It is a methylene urea technology, which would have a slow-release portion of nitrogen to it.

Slide 45

This is also a methylene urea slow-release fertilizer and it has a new dispersible technology which allows the granule to disperse immediately when irrigation is applied or rainfall occurs. This will limit the amount of granules that a homeowner might pick up with his or her mower after a fertilization application, as well as making for a more complete and even uptake of the fertilizer by the plants.

Slide 46

This is a picture of soundGRO or a bio-solid fertilizer that has just begun being produced from a Tacoma sewage treatment facility over near the Chambers Bay golf course. Notice that the percent of phosphorous in this natural organic product, pound for pound, is higher than with a synthetic organic product like a polycoated urea. Again, these types of products are best applied in the late spring and early fall to allow the micro-organisms to break down the nitrogen into nitrates that can be used by the plant.

Slide 47

Let's now talk about liming or calcium for use in the plant. Using a soil test, if the soil is found to be deficient in calcium, which it usually is in western Washington due to our high amounts of rainfall, then lime can be added to the soil in fall or early spring. If the lawn is already established, no more than thirty to forty pounds per thousand square feet can be applied to the surface of the grass without it looking like snow. If you are establishing a new lawn, then you can perhaps work in one hundred to one hundred fifty pounds per thousand square feet by rototilling it into the upper six to twelve inches. Again, a soil test will tell you whether you are deficient in strictly calcium, calling for an agricultural lime, or if you are deficient in both calcium and magnesium, which would call for a dolomitic lime. Eastern Washington soils are not usually deficient in calcium or magnesium, so it is generally not recommended to add lime to soils east of the Cascades.

Slide 48

This slide is showing us sprinkler heads covering a large turfgrass area, introducing our next topic.

Slide 49

In an IPM system we irrigate according to soil texture and depth. If you can remember back to slides earlier when we talked about how much water can be held in a six-inch depth of the different type of soils; that will help with the comparison. Establishment is the only time that irrigating frequently and shallowly is recommended. As the grass becomes established, say over the first several weeks, we lengthen the time between irrigations and water deeper during each application.
Slide 50

Continue on with irrigation practices. Apply the water slowly. Watering quickly is one of the most common mistakes. People try to put too much water on too quickly and it runs down the street or down the sidewalk. If the water is not being absorbed by the soil, then the grass is not going to be able to use it. You are actually wasting the water, not the grass. If the soil is very heavy, you are going to have to use several shorter watering cycles. This might mean you will need to irrigate the area for five minutes until the soil becomes saturated, then turn it off and wait a couple of hours. Run it for a few more perhaps five-minute cycles to be able to get the soil water to the depth - three to four inches that you might need. The last thing is, stop the irrigation water if it runs off the site. Again you can use a small spade to dig down to see whether the soil is saturated to a three- or four-inch depth where the roots can use the water.

Slide 51

Thatch is something that we have talked about earlier in the presentation and so I'd like to define what thatch is. Thatch is the vegetative matter between the soil surface and the green vegetation. We would like to have about a half-inch to three-quarters of an inch of thatch on a lawn. Once we get much above three-quarters of an inch, that's where we start talking about getting rid of some thatch on the lawn.

Slide 52

This is a picture of thatch in a Kentucky bluegrass lawn. You will see the grass up top and the thatch is the vegetative layer below that; approximately an inch of thatch. The brown layer where the label says mat is where some soil has been incorporated into the thatch. The dark layer below that is the soil. The thatch consists of rhizomes, stolons, and roots, but not grass clippings. Grass clippings usually break down at a very quick rate because they are made up of approximately 96% water.

Slide 53

Let's talk about the actual causes of thatch. Thatch accumulation occurs as a result of excess vegetative growth and a slower rate of decomposition. Some grasses and cultivars like the fine fescues and some of the Kentucky bluegrasses exhibit a greater tendency towards thatch. Mowing grass at too high of a height of cut as well as overwatering and over-fertilizing will create more thatch on a lawn. In western Washington, with lower soil temperatures and lower micro-organism activity, we can have more thatch than other areas due to our lower soil temperatures.

Slide 54

OK, what we are looking at here is a core of grass this has just been taken with a golf course cup cutter that I have here. And this is something that would be like a collar on a golf course green and it is a mixture of bentgrass and annual bluegrass and what you can see here if you see the point from here to here, that means I have about three-quarters of an inch of thatch right here. One thing I want to bring attention to, you can
see that we’ve top dressed over a period of time with sand and once again this is on the collar on a green, you can see there is a layer of thatch here, sand, a layer of thatch, sand, a layer or thatch, sand and it goes all the way through here. So on the golf course what they try to do, and actually if I turn it around you can see more, is we try to put enough top dressing on so we just have a nice even sand mix. But we don’t have enough labor to do that.

On a home lawn, what I would do is to make sure that I’m not overfertilizing, not overwatering, and that will cut down on the thatch. Especially with something like a fine fescue that can produce a lot of thatch because of the amount of lignin in the leaf tissue, but that’s what we need to look at is our cultural practices because thatch develops because we have a lot more vegetative growth as opposed to decomposition.

**Slide 55**

So, if we get too much thatch what should we do about it? Well, we’re going to have to do some thatch removal. Thatch should be removed in the spring or fall when the grass will be actively growing to fill back in. That way the grass will recover before any stress of the summer or winter periods. Sometime in April, or in early May on the east side, would be appropriate timing. Using a vertical mower dethatching unit with vertical knives that will actually go down and tear out the vegetative mat is what you want to do. However, the device should not reach into the soil, if you bring up soil the machine is set too low and you could run the risk of burning up the engine, which is not meant for that heavy type of work.

**Slide 56**

This is a dethatching job in progress on an older bentgrass lawn. Where you see the dethatching unit on the right half of the lawn is where it has been dethatched. This bentgrass lawn has more thatch than we normally would like to see. If you look on the left hand side of the lawn you will notice that there are a lot of brown spots, which is from the actual scalping of the lawnmower due to the excess thatch in the lawn.

**Slide 57**

Now, let’s go on and discuss the benefits of aeration. This picture shows some cores taken from a very good soil left on the soil surface. So why would we aerate it?

**Slide 58**

Aerification is done to reduce soil compaction. Pulling the cores from the soil will actually increase soil oxygen and water penetration and help us to get the root growth to go deeper into the soil and improve conditions for seeding. When we aerate is also a good time to apply fertilizer or lime to get it right down into the soil. If you decide to leave the cores on the surface and break them up, this can actually help reduce thatch by employing the micro-organisms in that soil to help break down the excess vegetative material. The timing for Aerification, once again, is spring and fall as the cool season grasses are beginning to grow so they will fill in quickly, or if you’re overseeding, the new seed will germinate to fill in the holes and keep out potential weeds.
Slide 59

Let's look at a diagram of aerification. This shows a compacted soil on the top, soil cores removed in the middle, and turfgrass roots going deeper into the soil on the bottom. The soil in the bottom picture has more oxygen in it due to the pulling of the soil cores.

Slide 60

This is a picture of a few recommended books for improving your knowledge of turfgrass problems with weeds and management/cultural situations. So this should help you to diagnose some turfgrass problems easier.

Slide 61

That brings us to the end of part one of turfgrass management, so you can continue on to part two to go on to diseases and other turf problems.