CULTIVATION AND THATCH CONTROL FOR TURF

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There are many potential causes for poor quality turf. Two of these are compacted soil conditions on which many turfs are growing and the development of a significant layer of thatch in the turf. Each can result in a unique set of management problems, and there are certain practices suggested to improve the conditions caused by each.

Compacted Soil Conditions

A high percentage of homes in Michigan have basements. All too often the contractor makes no provision for salvaging topsoil from the home site. The topsoil is either sold or buried under the subsoil excavated from the basement. Further, traffic on the site when the soil is wet and soft leads to compacted soils. The subsoil is then levelled to the grade preferred by the contractor, often when the soil is moist. The result is that in many cases the soil on which the turf is to be established is highly compacted subsoil.

Sod is often laid directly on the compacted subsoil with little attention given to soil preparation. Sodding conveniently covers the poor soil, and the homeowner is left to try to maintain his turf under conditions which often lead to failure. The landscaper who lays the sod is in a difficult position because proper soil preparation is costly and will usually result in a cost which is not competitive. The homeowner chooses the cheaper bid which ultimately may cost him much more in maintenance practices.

Traffic from people and equipment can cause compaction of the surface soil under turf conditions. The depth of compaction ranges from an inch or so to three or more inches depending on the frequency of traffic, pressure applied (pounds per square inch), soil texture, soil moisture and the amount of thatch and vegetation.

Compacted soil conditions (1,2,3) can result in a number of problems: 1) reduced rooting - the roots of the turf simply cannot exert enough pressure to grow into the compacted soil. This results in 2) greater moisture stress susceptibility. The roots are in contact with only a limited amount of soil so the turf will not be able to remove much available water from the soil. As a result, the turf will have to be watered more frequently just to keep it alive. Increased moisture stress 3) increases the susceptibility to certain diseases, most notably Fusarium blight, which has caused failure of many Kentucky bluegrass lawns.

The poor soil conditions result in 4) poor aeration in the root zone which contributes to poor rooting. These effects result in 5) poor growth. The turf has little vigor with 6) weed competition increasing. Compacted soil sites often have more knotweed and annual bluegrass. Management problems are increased because of 7) poor infiltration of water resulting in runoff and inefficient use of rainfall and irrigation. A turf growing on a compacted soil 8) lacks resilience and increases the potential for injury to people falling on the ground.

What can be done about compaction?

Relief from compacted soil conditions can be achieved by natural means and by cultivation practices. Given time, elements of nature can begin to give some improvement in soil physical properties through the effects of root growth, activity of earthworms and other soil organisms, wetting and drying, and freezing and thawing. This natural improvement takes time (it may be several years) and the results will be limited in depth.

Cultivation is suggested as a means of providing some improvement in the physical properties of the surface soil under turf. Core cultivation (sometimes called aerification) involves the removal of cores of soil. Coring units range in size from one-fourth inch diameter to three-fourths inch or more. Most equipment available is in the 1/2 to 3/4 inch range. These units can remove soil cores down to a maximum depth of 3 inches or so, depending on the particular machine and the soil conditions. The spacing of coring tines or spoons ranges from as close as 2 inches by 2 inches for coring units used on greens to spacings that are 6 to 8 inches apart. Coring machines utilize hollow tines, semi-open spoons or open spoons. The hollow tines remove soil by a primarily vertical action. The units utilizing spoons rotate on a drum, moving in an arc which can cause some dislodging of soil under the surface but may also lead to more disruption of the turf surface. This surface disruption will be of less concern on general turfs than on closer mowed turf such as golf greens.

The objectives of core cultivation (1,2,3) include:

1) Reducing compaction in the surface layer of soil. This will be effective to the depth that the cores will penetrate. Below that point there will be no improvement. In fact, there is evidence that there is slightly increased compaction at the bottom of the coring hole. Normally this should be of no concern as the relief of compaction in the surface layer is the primary objective.

2) Improved gas exchange means getting more oxygen into the soil and getting the carbon dioxide and other gases out of the rootzone.

3) Improved infiltration of rainfall and irrigation water on sloping sites, which will result in better utilization of moisture and less moisture stress.

4) Breaking up undesirable soil layers in a the surface. Differing layers of soil can result in poor rooting and nonuniform water movement.

5) Bringing soil to the surface with the cores which can be broken up and dispersed into the thatch layer provides a more favorable environment for thatch decomposition. Control of thatch is easier when soil is periodically added to the thatch.

6) Loosening of the soil can lead to a gradual improvement in resilience.

7) Opening of the soil by core cultivaton permits deeper penetration of lime and nutrients from fertilizers applied on the surface. Better growth should improve responses to fertilizers and other treatments as well.

8) Overseeding and renovation of poor quality turfs can be enhanced by core cultivation.

9) When cultivated during active growth periods there may be some stimulation of the turf. Timing of cultivation to avoid serious stress conditions is important. Growth of roots in the coring holes will normally result after core cultivation.

10) The ultimate goal is to improve the turf and help it become more vigorous and stress tolerant.

Cultivaton practices are best used during minimal stress conditions since cultivation will cause some injury to the turf. If coring is done

when temperatures are high or moisture stress occurs, special attention must be given to careful watering practices to prevent significant stress. When done during periods of active growth, the turf can recover from injury caused by cultivation.

It is essential to use cultivation when the soil moisture is appropriate. If the soil is too dry, the tines or spoons may not penetrate the soil to the depth desired and often, on the areas needing the coring most, the coring unit will not penetrate the soil adequately. On the other hand, if practiced when the soil is too wet, the coring unit may not work properly, plugging the tines and causing significantly increased compaction and disruption of the surface.

If possible, it is wise to cultivate the turf during periods when the turf is not in significant use and when labor is available. Timing of coring is also important with reference to weed seed germination periods. This could result in increased weed encroachment of the turf. This is particularly important for crabgrass infested turfs. If a preemerge crabgrass chemical has been applied, there should be no cultivation, dethatching or other operations practiced which could disrupt the chemical barrier and allow crabgrass to get established. Timing of cultivation should also be considered when annual bluegrass or goosegrass problems exist.

One should remember there are certain concerns which must be considered with core cultivation. Obviously, effective equipment and good labor to operate that equipment are necessary. While there are some very effective coring machines on the market, there are others which are not as effective. Cultivation can disrupt the turf surface, interfere with use of the turf, result in injury and exposure of the turf to stress, increase the potential for establishment of certain weeds, and may cause a minor amount of compaction deeper in the soil.

Most of the results of core cultivation are normally of longer duration. Remember that the amount the surface affected is relatively small. Table 1 gives some relative figures for the percent of the surface affected with varying tine sizes and spacings. With many coring units only a small percentage of the surface is exposed.

Table 1. Effect of tine size and spacing on percent of soil surface exposed by core cultivation.

Tine diameter	Area of tine	Percent of surface exposed			
inch	square inch	2"x2"*	2"x4"	4"x4"	4"x6"
.25	.05	1.2%	0.6%	0.3%	0.2%
.5	.20	5.0	2.5	1.3	0.8
.75	.44	11.0	5.5	2.8	1.8
1.0	.79	19.6	9.8	4.9	3.3

* Spacing between tines is 2 inches by 2 inches, etc.

Thus it may require several passes for effective coring. One must consider what to do with the cores of soil. If the coring machine collects the cores then they can be removed easily from the turf site. If the cores are returned to the turf surface, they may be left to break down naturally. In most cases, however, this would be objectionable as the cores may leave an unsightly appearance and cause the turf to become rough and bumpy. In most

cases, the use of a verticutting machine to break up the soil cores is practiced. This helps to disperse the soil more uniformly back into the thatch layer, encouraging thatch decomposition. If there is an appreciable thatch layer, the thatch debris may be sufficient to necessitate the removal of this debris with a blower or by raking, sweeping or with a vacuum unit.

The use of verticutting is most effective in breaking up soil cores if the cores can dry somewhat after core cultivation. When cores are too wet or too dry, they do not break apart easily. In a lawn maintenance operation timing of these practices is difficult for maximum effectiveness versus maximum efficiency in costs.

When the soil compaction is present throughout the soil profile, core cultivation is beneficial in the surface layer even though it cannot improve the soil below the coring depth. At least the surface rooting zone can be improved.

It is clear that there is great potential for core cultivation in lawn care maintenance. This can make the turf easier to maintain and result in better turf as well as provide a significant source of income for lawn service companies. Core cultivation could be done during less busy seasons to spread the labor needs.

Although core cultivation can be used effectively on many turfs, it may not be needed on others. Evaluate your turf carefully for compaction, rooting and thatch. When using core cultivation, be sure the soil moisture range is appropriate for effective operation of the equipment. At Michigan State University we are encouraging the use of core cultivation of home lawns and other turfs, especially when compaction and thatch problems exist.

Thatch

The development of a thatch layer in turf is a natural result of turf growth. Thatch is a layer composed of both living and dead roots and stems that develops between the soil surface and the green vegetation in a turf (1). Some thatch is desirable in that it provides resilience and wear tolerance in a turf and may reduce temperature extremes in soil.

When the thatch layer exceeds one-half inch on general turfs, the potential for several problems (1,2,3) increases: 1) Rooting is often limited to the thatch layer making the turf more susceptible to moisture and other stresses; 2) There is increased potential for disease and insect activity; 3) The thatch layer can become by hydrophobic; reducing infiltration and increasing runoff and localized dry spots; 4) The thatch layer may reduce the effectiveness of certain pesticides, limiting their activity or uptake; 5) With a significant thatch layer the crowns may be elevated resulting in scalping when mowing the turf and making the turf more susceptible to temperature extremes. Thatch makes overseeding operations more difficult. Successful overseeding is dependent on getting seed in contact with the soil. The presence of a significant thatch layer can prevent this.

Thatch control

When the thatch layer exceeds one-half inch on home lawn turfs, one should consider using control measures. Control of thatch can be accomplished naturally (biologically) or mechanically (1,3). Biological control is dependent on earthworms, other insects and the soil microorganism population. The use of pesticides which control (directly or indirectly) these organisms can increase the probability of thatch accumulation.

As indicated in the previous section on core cultivation, an effective method of combining biological and mechanical means in thatch control is coring. Breaking up the soil cores permits a light topdressing of soil which can fall into the thatch layer providing a better environment for soil organism activity and thatch decomposition. The amount of soil brought to the surface and returned to the thatch is very important in how effective this means of control will be. More soil will normally mean better thatch control. One should be careful to prevent the develoment of a soil layer above the thatch layer which could occur with too vigorous coring, however. The probability of this occurring is small, however, because of economic reasons in the cost of coring.

Mechanical removal of thatch is done with a vertical mowing or dethatching machine. These machines have a series of rigid or flexible blades or tines that operate vertically. These units can be set 1) shallow enough to merely cut the green grass vertically, 2) at medium depths to cut down into the thatch layer to remove some of the thatch or 3) set deeply to cut through that thatch in to the soil below. The depth of operation will depend on the objective. When set deeply into the soil, this can be used for overseeding operations.

When using these units for thatch removal, one should remember that this treatment will cause injury to the turf. The amount of thatch removed and the degree of injury to the turf will vary with the particular machine. As with other types of equipment, some units are very effective and others may not be very useful.

Timing of vertical mowing or dethatching is important. Normally this should be done during a period of active growth so the turf can recover from the injury which occurs. Avoid periods of high temperature stress (or moisture stress without irrigation) or times when the turf is particularly susceptible to disease such as leafspot or Fusarium blight. Remember to not vertical mow after preemerge treatment for crabgrass (or other weeds) until after the prime time for germination is past.

The number of passes needed to reduce the thatch layer will depend on the depth and density of the thatch, the condition of the turf and the effectiveness of the machine used. Do not attempt to remove all the thatch in one pass as this would normally cause too much injury to the turf.

Thatch control is a long term project. Some thatch is acceptable. Wise turf management involves thatch control. Vertical mowing or dethatching is just one part of thatch control. Proper selection of grasses, moderate fertilization, traffic effects, proper watering, good soil physical conditions, adequate drainage, control of soil pH, proper use of pesticides, cultivation and encouragement of the activity of soil organisms all play roles in thatch control. Wise use of thatch control and cultivation can help to provide a beautiful turf which is easy to manage and has good stress tolerance.

References

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