

## **FITTING THE CULTIVATION PROGRAM TO YOUR NEEDS**

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The turf manager faces many challenges in the course of providing the quality of turf desired. One of the more difficult challenges is how to determine the need for and how to plan an effective cultivation program. There are three basic questions to be answered. First, what is the problem which needs to be corrected? Secondly, what cultivation equipment will provide the most effective means of attacking the problem? Third, what intensity of cultivation with the appropriate equipment will be needed to improve the situation? In other words, what cultivation program will be needed for a given turf? In some cases, a combination of cultivation practices may be necessary to solve the problems at hand.

### **DEFINING THE PROBLEM**

Careful evaluation of the turf and soil conditions is necessary to determine which problem (or problems) exists. The most important problem to be solved can vary significantly from one turf area to another. Some conditions are easily identifiable, such as excessive thatch; layers in the soil profile caused by improper construction techniques, improper topdressing programming or siltation from flooding; poor infiltration caused by surface compaction; or black layer development.

Serious soil compaction problems, whether at the surface or deeper in the profile can usually be recognized. However, a modest degree of compaction which limits root growth or internal drainage is more difficult to discern. Careful observation of soil density, soil moisture movement and rooting can be helpful tools in diagnosing compaction problems. For example, some golf course superintendents have located the presence of a cultivation pan below the surface (layer of compacted soil caused by cultivation to the same depth over several years) by use of a soil probe or a metal rod, or by noting that roots clearly stop at a given depth associated with cultivation depth.

Obviously, if the problem(s) identified is caused by improper management practices, correction of management should be the first priority. But the limiting soil problem will still exist and must be addressed if a quality, functional, stress tolerant turf is to be provided.

The general objectives of cultivation practices are: 1) to relieve compaction; 2) to aid in thatch control; 3) to break through soil layers; 4) as a tool in modifying soil texture when accompanied by topdressing; 5) for overseeding and renovation of turf; 6) as a tool in rejuvenation of turf by severing

stolons or rhizomes; and 7) to enhance deeper penetration of fertilizer and lime. The three most common uses are for relieving compaction, in thatch control and as a tool in seeding and overseeding.

In relieving compaction, cultivation can enhance gas exchange (aeration), infiltration and permeability of water through the soil, provide better soil conditions for easy rooting which should provide better moisture stress tolerance. Improvement in soil conditions should result in a turf which can more readily tolerate stress conditions, a primary goal in turf management.

## SELECTION OF CULTIVATION EQUIPMENT

Once the problem is identified one can then consider which type of cultivation tool will address that problem. If there is a significant thatch problem, cultivation is a primary tool to use. The key benefit comes with mixing soil from the cores into the thatch layer. This practice may improve biological activity which could result in decomposition of some of the thatch, although this has not been clearly proven in the literature. On the other hand, the soil from core cultivation may simply cause a dilution of the thatch with soil. If cultivation is practiced aggressively enough over a long enough time, the soil from the cores should be mixed into the thatch layer such that a distinct layer of thatch is not clearly evident. Any cultivation tool which brings soil sufficient soil to the surface can be helpful in dealing with an existing thatch. The more soil is brought to the surface, the more effectively cultivation will affect a thatch condition. It is also very important to adjust management practices to reduce the rate of thatch accumulation.

If soil layers exist in the depth of soil which can be reached with a core aerifier, this can be helpful in reducing the effects of layers. Such layers may have resulted from improper topdressing programs or occurred during construction. By removing soil cores followed by topdressing, the topdressing soil provides a continuous contact through the layers to the underlying soil. If this program is followed over a period of years, more and more of the layer is removed and more uniformity in the soil results. This will occur as long as the cultivation tool can reach through the layers present. Again, any tool which removes a soil core can be used effectively in dealing with layers and it is obvious that any cultivation tool which does not remove a soil core will have little direct impact on thatch or layer problems.

Cultivation equipment which removes a soil core can also be effective in enhancing downward movement of fertilizer or pH control applications. Severing stolons or rhizomes with core cultivation equipment tends to cause the plant to be rejuvenated, increasing plant density if not done too aggressively and if done at a time when weather conditions are conducive to quick turf recovery.

Any tool which causes a loosening of the soil should relieve soil compaction problems to some degree. Examples are the vertical operating units; those with spoons on drums or wheels; and the Hydroject. Another example which can be used in certain situations is the Aer-Way. The smaller vertical operating units are most effective when using hollow tines with the soil cores either removed from the site or worked back into the turf. In certain situations, solid tines can be used to relieve soil compaction at times when surface disruption from the presence of soil cores from hollow tines is not acceptable. Some golf course superintendents have used solid tines on high, dry spots on greens to enhance infiltration during the summer, reducing dry spot problems. Others have used the solid tines in highly compacted areas like the mower ring around the green. Use of solid tines is not recommended as a routine practice on most soils because there is a greater tendency for solid tines to develop a cultivation pan than is apparent with hollow tines. For either type of tine, it is advisable to vary the depth of cultivation to prevent development of such a cultivation pan.

The Verti-Drain is a much larger type of vertical operating aerifier. The action is not a true vertical action as the tines are pulled out of the ground on a small angle from vertical. This combination results in a significant loosening of the soil. Because of the large tractor required and the weight of the aerifier, the large Verti-Drain unit may be too aggressive for some turfs, such as greens. There is a smaller Verti-Drain unit available for such turfs, however. When hollow tines are used with the Verti-Drain, a large amount of soil can be brought to the surface, especially when operated at the slowest speed (closest spacing). Some golf course superintendents have used the solid tines, then topdressed into the resulting holes. Because no soil or turf is removed, it is advisable to

use larger diameter tines to leave a large enough hole so topdressing material can be worked into the hole. On highly compacted sites, a practice which has worked for some is to use the Verti-Drain (or other aerifier) set at a more shallow depth, then on successive treatments, gradually lower the unit until it reaches the full depth.

Those cultivation units which operate with spoons (either open or closed) on drums or wheels vary significantly in depth attained, spoon spacing and effectiveness. Several of these units are very useful and have proven valuable for many years. However some units are so light there is little penetration into the soil. An aerifier should be checked carefully before purchase to be sure it will accomplish what is desired under the conditions in which it will be used in the field. Almost any unit will work on loose soil. But will it reach deep enough into the soil and remove enough soil to accomplish the desired goal on a highly compacted, dry soil? I have visited several grounds operations (particularly school grounds and athletic fields) which have a unit that will not solve their problems. Far too often they have been sold a slicer (cheaper cost) rather than a good aerifier. These types of aerifiers can be used for soil preparation in overseeding and turf establishment operations.

We have studied the use of the Hydroject from the Toro Co. for several years. This machine utilizes the action of higher pressure water pulses through nozzles. This tool will loosen the soil under most conditions, improving infiltration and rooting. One of the significant advantages is that it can be used several times during the growing season with little disruption of the turf surface. Golf course superintendents have reported excellent results on compacted greens with applications as often as every two weeks. Most sites would not need that frequency, of course. In fact, such frequency of use may be harmful on some turfs. Although the action of the high pressure water through the nozzles does not leave a very large hole, our research data indicate there is loosening of the soil, with improved infiltration and rooting.

Another unique cultivation tool is the Floyd-McKay drill aerifier. The drills remove some soil, but no turf. We have had limited experience with this unit.

The value of cultivation tools in renovation and for soil preparation for seeding or sodding has been overlooked. any tool which loosens the soil effectively and brings soil to the surface can be used in renovation procedures. If the existing turf is killed with Roundup applications and the thatch layer is less than 1/2 inch, cultivation may be adequate for renovation. Several passes will be necessary to bring enough soil to the surface to provide good seed to soil contact. For new turf sites, we have found cultivation with hollow or solid tines just as effective for soil preparation as was rototilling, plus less smoothing of soil before seeding or sodding was necessary than with rototilling.

## PLANNING THE CULTIVATION PROGRAM

When planning a cultivation program, timing is one of the key factors. An effective cultivation tool which loosens soil will cause some injury to the root system of the turf. Is the turf strong enough to recover from that injury? At the end of a particularly stressful period caused by temperature or moisture stress and/or traffic, the turf may be so weak that cultivation should be delayed until the turf is stronger. And what type of treatment is needed? Evaluation of the problem to be solved and which equipment will be effective in solving that problem must be answered first.

Because cultivation is likely to cause some injury to the turf, it is usually best to apply cultivation treatment when the weather is appropriate for turf recovery from any injury incurred. This may not always be possible. An exception might be when the soil is so compacted near the end of a stressful summer. Cultivation is needed for turf recovery from the stress, but the turf is too weak for normal treatment. Perhaps one could reduce the intensity of cultivation by making holes farther apart, using smaller diameter tines or cultivation to a shallower depth until the turf is stronger or the weather is less stressful. One might also consider fertilizing a week or so before cultivation so the turf is actively growing at the time of cultivation, which should encourage rapid recovery.

The prime germination periods for weedy species are in spring and fall, depending on the weed. For example, cultivation in the spring may expose the turf to greater crabgrass germination. Evaluate a given site for which weeds are likely to be the greatest problem and plan the cultivation program so that it will not coincide with the prime germination period for that weed.

Most cultivation equipment will not work well when the soil is too dry and compacted. Usually, the equipment will work better when the soil is more moist. Still cultivation should not be done when the soil is too wet which can lead to greater compaction. This becomes a judgement call, depending on the soil and the equipment available. Generally, there will be more damage to soil structure with higher clay content if equipment is used when the soil is wet.

Another factor in timing of cultivation is when the necessary labor is available to accomplish the task. Also, labor may be needed for other maintenance activities. What window of opportunity is there to apply cultivation treatments? Some athletic fields, parks and golf courses are so heavily utilized there is almost no time available to aerify and allow for turf recovery. Those responsible for athletic field scheduling, for example, should leave appropriate time to permit these maintenance activities. This should be considered necessary preventative maintenance.

For maximum effectiveness on certain sites with unique problems which cannot be solved with one type of aerifier, it may be necessary to use a combination of cultivation treatments. One may use hollow tines in spring and fall, while small diameter tines could be used in the summer as needed. Or the summer treatment might be accomplished with the Hydroject.

## **SUMMARY**

As with any maintenance program, the results of cultivation should be evaluated to determine if the desired objectives are being achieved. In some cases, a more intensive cultivation program may be needed because compaction effects continue to limit root growth or the thatch layer is not being controlled, for example. In other situations, the intensity of cultivation may need to be reduced because the turf is too weak or the treatment is too aggressive. These judgements must be made on a site by site adjacent turf. Once you have evaluated what the cultivation program has accomplished, adjust your plans accordingly for next year. By studying soil conditions more carefully, one can learn more about how to use cultivation so good decisions can be made about how to fit the cultivation program to your specific needs.