Basic Principles of Aeration

by

Tom Mascaro, *Director, Product and Market Development, Hahn-West Point Division*

'Roots do not grow in the soil, they grow in the spaces within the soil.'
'Water does not move through the soil, it moves through the pore spaces within a soil.'
'Air does not pass through the soil, it moves in the spaces within a soil.'
'Nutrients do not move in the soil, they move in the spaces within a soil.'

The need for aerification of a turfgrass area is determined by the above statements. Aeration of soils under turf is, simply stated, the mechanical manipulation of the soil to renew soil structure. It is a modified form of ploughing without materially disturbing the turf surface. When soils are ploughed (to renew soil structure) the sequence that takes place is as follows. The shape of the plough is designed to lift the soil, gently turn it over, and move it to a new location. This process of lifting and relocating the entire soil mass, renews soil structure. Spaces are mechanically created to provide channels, or pore spaces, for the free movement of roots, gasses, nutrients and water.

Implements for renewing soil structure on turfgrass areas are specially designed to perform the same function as the plough. The difference, however, is that instead of lifting and relocating the entire soil mass, the operation is modified in order to leave the turf surface relatively undisturbed. This is accomplished by means of concave steel elements, commonly called spoons. The steel elements penetrate the soil, scoop it out and eject it on the turf surface. Like ploughing, the soil is lifted and relocated. The design of the aerating machine determines the number of loose walled cavities created per square foot. Turfgrass areas aerified on a management basis will, over a period of time, have all of the soil relocated and structurally modified.

Aeration of turf grass areas should be viewed as a process that actually has a three-fold purpose. The first purpose of aeration is to renew soil structure. The second purpose is to utilize the soil removed in the process to assist in the decomposition of surface thatch. The third purpose of aeration is to keep the grass areas level.

The need for renewing soil structure has already been discussed. The second purpose for aeration, that of utilizing the soil cores to help decompose thatch, is self-evident. Decomposition of thatch is materially hastened when soil with its decomposing organisms, plants and fungi, is in intimate contact with the accumulated material. The third purpose of aeration utilizes the soil removed from the root bed to fill depressions, thus keeping the turf surface level.

Depending upon the type of aerator used, as much as eight to ten tons of soil per acre are deposited on the turf surface. These soil cores, when pulverized with a dragmat of sufficient width, fill depressions.

Forces which determine the need for aeration.

It has often been mis-stated that turfgrass areas which have no traffic need no aeration. The facts are, the need is not as great as compared to heavy use areas but the benefits are most decidedly evident.

All turfgrass areas are constantly being subjected to compacting forces. The mechanical action of rain or irrigation water is a compacting force: the movement of water through a soil conveys the finer particles and gradually fills the pore spaces.

The pounding and rolling action of human feet subject soils to severe compaction. It has been estimated that the foot of an average human will apply a pressure of 94 pounds per square inch.

The weight and rolling action of maintenance and other equipment subject soils to severe compaction. In these cases, puddling, due to the kneading action of the wheel, is

far more of a compacting factor than is the weight of the vehicle. According to a manufacturer, a fully-loaded golf car, equipped with flotation tyres, exerts only eight pounds per square inch. However, they make no mention of the puddling effects of such a tyre. Documentation at the Georgia Coastal Plains Experiment Station reveals that compaction on relatively sandy soils is very severe when subjected to the forces of these tyres.

Compaction Indicators

Numerous methods can be employed to determine the compactability of soils. Various laboratories equipped to make these determinations are available. For the most part, observation or 'eye balling' can be very helpful in determining the degree of compaction and the need for aeration to renew soil structure. The following are some excellent indicators:

- Poor water infiltration. If the soil does not absorb at least an inch of water per hour, compaction may be a significant factor.
- The presence of knotweed and crabgrass are usually good indication of soil compaction.
- Blue, mottled or putrid soils. Compaction promotes an aerobic activity. Iron in the soil changes to a blue or dark mottled colour. A putrid odour (due largely to methane gas) is evident when a fresh sample of the soil's profile is smelled.
- A shallow root system: as mentioned earlier, roots do not grow in the soil; they grow in the spaces within the soil mass. Roots cannot penetrate solids. Soil particles pushed together by compacting forces severely restrict root growth.
- High salt index at the soil surface. Salts, accumulating from fertilizer and exudated water are held near the soil surface, since compaction prevents downward movement. Detection of excess salts can be determined in the lab. and also by the detection of stem burn at the soil surface.
- Poa Annua, being largely a surface grower, can survive and grow quite well on compacted surfaces. This is essentially true if management practices such as frequent light irrigation, surface feeding, etc., are practiced.
- Run-off-water. Water accumulating in low lying areas indicates that infiltration is poor. It has been determined that as much as 70% of applied water will run-off of a severely compacted turfgrass area.

Management versus Renovation

The use of aeration equipment can be divided into two separate and distinct categories. One is aeration on a continuing management basis to keep up with soil compaction as it forms. The other is to allow compaction to become so severe that turf has deteriorated to the point that complete renovation is necessary. Specification must be based on the type of programme being followed. Aerification done on an 'occasional basis' should be considered practically worthless.

If a turfgrass area has deteriorated to the point where less than 50% of the turf is composed of desirable grasses, then renovation aeration should be employed.

A complete renovation programme will consist of:

- Complete removal, or chemical kill, of all existing vegetation, or a combination of both.
- Severe aerification consisting of at least 10 passes over the area at full depth with an aerating tool. (A good rule of thumb is when the area appears to be ruined, you are half-finished aerating). Each pass over the area should be done from a different angle.
- Lime if needed, and apply fertilizer as determined by soil tests.
- Dragmat the area until soil is pulverised to form a good seed bed. This will also level the area.
- Seed or stolonize the desired grass or grasses.
- Keep moist, but not wet until turf is established.

Management Aeration

When a turf grass area is over 50% populated with desirable grasses, a programme of management aeration can be initiated.

Aeration is done on an 'as needed' basis. In order to minimise disturbance of the turf surface (and its use) the first aeration is done at a slow speed. The area is then carefully dragmatted to pulverise all soil cores. On a management basis, aeration is always done prior to fertilisation and liming.

Water infiltration is correlated with the need for aeration and done when needed. No set rules can be applied to a management aeration programme. The turf manager must correlate all indicators of compaction and perform the operation in relation to them.

Aerifying 'by the calendar' is as senseless as irrigating every third Monday. The type of soil, the use of the area, etc., are all determining factors as to when management aeration should be done. Generally speaking, however, the autumn period is a critical time for aeration. This is a period in the life cycle of the grass plant when root growth is at its greatest. Aeration will contribute to good growth at any time during the growth period but aeration of the turf in the early autumn will largely determine the health and vigour of the grass for the following season. Many good turf managers follow the rule, 'What I do for my turf today will determine its condition a year from now'.

Costs for aerification are difficult to determine on a national basis. Consideration must be given to the size of tractor used, prevailing manpower costs and whether the turf grass area is open and clear, such as a fairway, or landscaped with trees, shrubs and walks, such as park areas. Depreciation and repairs must also be taken into consideration. All of these factors can best be determined by the turf manager.

One of the greatest misconceptions relating to the practice of aeration is the fear that disturbing the turf surface will promote weed invasion. This concept is as relevant as keeping soils acid to prevent weeds. The presence and growth of weeds in a turf grass area is the most reliable indication that something is basically wrong with the management programme. Unless the basic problem or problems are determined, weeds will always be present. Basic problems which must be determined and alleviated are: soil compaction, the wrong grass for the climatic area and use, improper irrigation practices, inadequate or imbalance of nutrients, or mismanagement, such as height of cut, air drainage, etc.

Aeration, therefore, is the catalytic agent that allows the turf manager to utilize all the other methods he employs to produce healthy turf. We must conclude, therefore, that the turf manager who is reluctant to aerate because he fears weed invasion, is the man who has not learned to seek out and correct the basic problems.

SELSDON PARK HOTEL

SELSDON PARK HOTEL is the first hotel in Britain to install a pop-up sprinkler system on a golf course.

The Hotel has invested £12,000 to provide complete coverage at the 18 greens, 2 practice putting greens, approach aprons of 6 greens and 2 main hotel lawns.

Commenting on the installation of the American Toro system, Mr Basil Sanderson the hotel owner, said that the greens on the 5,800 m. course would now remain in peak condition in dry spells; and instead of dragging heavy hoses across the course, interrupting play, the important areas would be covered in 10 minute cycles at night.

The accurately controlled water application will not only save labour but also create consistent holding on putting green surfaces and improve the wearing quality of the turf to enable it to support a heavier weight of play.