The Air2G2 unit is highly effective at shattering compacted layers deeper within the profile of sports turf surfaces

Getting air

AGCSATech senior agronomist Bruce Macphee presents the findings from some recent trial work assessing the effectiveness of the Air2G2 unit.

Traditional renovation practices are often disruptive to playing surfaces, particularly on fine turf surfaces such as putting greens. With less time allotted for turf managers to undertake the works required to maintain optimal growing conditions throughout the year, they are always looking at other options to assist in maintaining high quality turf surfaces.

There is a wide range of equipment currently available to the turf manager to assist in maintaining turf, with the more traditional methods causing disruption for several weeks. Increased pressure from members, impact on cash flow with fewer visitors throughout the recovery period and very busy schedules have led turf managers to look for other options.

The concept of compressed air injection is not a new one, with developments occurring simultaneously in both the turf and arboriculture industries. While slightly different, the concept is the same – fracturing the soil which allows increased aeration and percolation of water through a compacted soil profile with minimal disturbance of the surface.

Glen Black is credited with developing the technology and idea in the early 1970s where a single tine was used to inject high pressure air into troublesome areas on greens. That would lead to the development of the Air2G2 unit the industry knows today. Other similar devices have come and gone during that time, with the Air2G2 unit launched in 2011. The unit (*pictured above*) consists of three probes 600mm apart, providing a working width of 1.8 metres. The probes can be inserted to a maximum depth of 300mm with the ability to fire compressed air at two depths as the probes penetrate the soil profile.

As with all turf surfaces, there are various options available to complete renovation works, primarily relieving compaction or physical removal of thatch. With these methods there is often an additional consequence – disruption of the surface, extended recovery or in some cases the development of a hard pan within the profile as a result of impact from hollow coring or solid tining.

In 2022, AGCSATech, the ASTMA's technical division, established a small trial on the 5th green at Frankston Golf Club in southeast Melbourne, Victoria to assess the length of time and effects from one Air2G2 treatment at various depths throughout the green profile. The green selected was of mature age (30-plus years) with a surface consisting of a creeping bentgrass and *Poa annua* mix. The green was a push-up construction comprising medium fine local sands typical of those occurring within the Melbourne Sandbelt, with a thatch and sand layer about 40mm thick.

AGCSATech proposed to investigate the length of time the effects of one treatment lasted, the effect on infiltration rate, soil compaction, root growth and where changes occurred at various depths within the profile. Several other trials have been conducted in the past on the effects of the Air2G2 unit (*see references*). Some of the previous research focussed on the physical changes to the profile, soil porosity, soil bulk density, surface hardness, infiltration, root depth, effect on microbial populations and green speed.

METHODOLOGY

The green used for this study had not been previously treated with an Air2G2 unit and was given a single treatment on 25 July 2023 which is mid-winter in Melbourne, with soil temperatures typically below 12°C and growth

is at a minimum. Prior to treatment the greens were assessed for infiltration, average thatch depth, average root depth and compaction resistance at 100mm, 175mm, 225mm and 300mm depths.

RESULTS
INFILTRATION

Infiltration rate was assessed using a single ring infiltrometer with the results showing the surface draining at less than 1mm/hour prior to treatment. The existing thatch layer was determined as the overriding factor affecting infiltration. Test results after treatment showed an increase in infiltration of four per cent. Infiltration was also assessed with the thatch layer removed both pre- and post-treatment. There was a 66 per cent increase in saturated hydraulic conductivity after treatment where the thatch layer was removed.

The development of thatch within the surface of a profile has by far the greatest influence on infiltration and the ability to produce a consistent, high quality surface. While the Air2G2 unit does not target thatch removal, it is highly effective at reducing the issues associated with physical removal including shattering compacted layers deeper within the profile.

SURFACE HARDNESS

Surface hardness was assessed in six locations using a 2.25kg Clegg Hammer with the results averaging 50 gravities. There was no significant difference after treatment, so readings were discontinued. This result may have been attributed to climatic conditions and the presence of a moist thatch layer absorbing any impact at the time of the trial. This does highlight the unit can be utilised with minimal disruption to play or surface quality.

ROOT GROWTH

The development of an extensive root system is vital in maintaining high quality turf surfaces. Many turf managers face challenges in encouraging a deep extensive root system when maintaining a fine cut turf surface. At the time the assessment was undertaken, soil temperatures were hovering between 10 and 12 degrees and not conducive to rapid root growth. The majority of roots were confined to the top 40mm of the surface (as expected for that time of the year).

New roots were observed growing within an injection hole 18 days after treatment when inspecting the profile. Observations have

New root growth midwinter in the tine injection site following treatment with the Air2G2 unit

shown similar results with hollow coring or Verti-drain holes where additional root growth can be observed within holes where there is minimal resistance and rapid root growth is experienced.

COMPACTION RESISTANCE

Compaction resistance was measured using a soil penetrometer as the probe is forced through the soil profile. Readings were taken every 75mm from the surface to 300mm deep. There were six locations on the green assessed for compaction resistance, with the results shown in Table 1 and Figure 1. Compaction was significantly reduced immediately after treatment, particularly within the 100-225mm section of the profile. While there was some return the following week, the effects of the single treatment lasted throughout this region for the trial duration.

The following observations regarding compaction were made:

- There was a significant reduction between the 100mm and 225mm sections of the profile which lasted the duration of the monitoring period.
- The greatest effect was immediately after treatment with a reduction of 28 per cent in compaction in the 100mm-175mm section and a 41 per cent reduction in compaction in the 175mm-225mm section.
- Over the six-week trial, the results showed an average reduction in compaction within the 100mm-175mm section of 15 per cent.
- Average reduction in compaction for the 175mm-225mm section was 22 per cent.
- There was a three per cent reduction in compaction in the top 100mm of the profile, which is to be expected with regular aeration undertaken as part of an overall maintenance program.
- There was a three per cent reduction in compaction at 300mm deep.

TABLE 1. COMPACTION REDUCTION %

Depth	1 DAT	10 DAT	18 DAT	25 DAT	32 DAT	40 DAT	Ave reduction
0-100mm	4.0	4.0	0.0	4.0	4.0	4.0	**3%**
100-175	28.0	16.0	12.0	10.0	12.0	12.0	**15%**
175-225	41.0	19.0	17.0	16.0	22.0	20.0	**23%**
225-300	7.0	9.0	4.0	0.0	0.0	0.0	**3%**

CONCLUSION

The Air2G2 unit can effectively be used to target areas within the profile beyond that of traditional renovation equipment. Over time, regular use of hollow coring equipment can result in the development of hard pan layers deeper within the profile, which can affect water infiltration, root development and aeration. The Air2G2 unit offers the advantage of providing minimal disturbance to the surface or interruption to play after treatment. It is effective at relieving compaction deeper within the profile after one treatment and providing the benefits from increased aeration.

The Air2G2 unit is an effective implement which can be used regularly on a range of fine turf surfaces with minimal disruption. As part of an overall maintenance plan, the unit can target compaction deeper within the profile, encourage root development, assist water movement and gaseous exchange.

The unit is not designed to reduce organic matter, however, it is highly effective at shattering compacted layers deeper within the profile. While the surface infiltration rate may be governed by the accumulation of organic matter and thatch, deeper within the profile where soils can become highly compacted, the unit offers a highly effective way of improving aeration, gaseous exchange, water infiltration and reducing compaction. The unit is also effective where thatch layers are preventing oxygen reaching deeper into the profile on all sports turf surfaces and a range of different profiles.

REFERENCES

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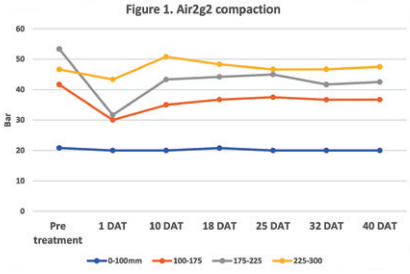

Figure 1. Average results and percentage reduction in compaction throughout the profile when compared to pre-treatment results