# INTERIM REPORT:

## To determine the effect of the Sandcat on turf health, surface and soil performance – 2014 data.



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CONFIDENTIAL

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## Summary

The objective of this trial is to investigate the impact of using the Sandcat machine on putting surfaces. The effects of this operation on turf quality and health, surface compaction, water retention and ball roll characteristics were measured. Additionally, measurements of rate of turf recovery from the Sandcat operation was assessed, in conjunction with the use of Vision Pro turf pigment. The Sandcat resulted in a consistently drier, firmer and truer playing surface. Water infiltration rates were over double those measured on turf not treated with the Sandcat. These results show the real benefit of using the Sandcat on soil-based greens that have agronomic issues.

## Materials and Methods

| | | |
|---|---|---|
| Field site | : | The trial was carried out on area D4 at STRI's Research Facility at Bingley, West Yorkshire. The area had a native soil (sandy loam type) with a mixed annual meadow-grass/bent sward. |
| Timing | : | Two Sandcat operations were carried out in 2014 (19 June and 24 September). A further two Sandcat operations are planned for 2015. |
| Experimental design | : | The trial area was split into two, with one half treated with the Sandcat, whilst the other half will be untreated. The trial was analysed using T-tests. Additionally, each half of each Sandcat treated area either had Vision Pro/Transition applied or left untreated to evaluate whether this sped up turf recovery. |

## Assessment dates

| Date | Assessments | DAT |
|---|---|---|
| 20.06.14 | Penetration depth, hardness, VWC, smoothness, trueness, line recovery | 1DAT1 |
| 27.06.14 | Penetration depth, hardness, VWC, smoothness, trueness, line recovery | 8DAT1 |
| 04.07.14 | Penetration depth, hardness, VWC, smoothness, trueness, line recovery | 15DAT1 |
| 11.07.14 | Penetration depth, hardness, VWC, smoothness, trueness, line recovery | 22DAT1 |
| 17.07.14 | Penetration depth, hardness, VWC, smoothness, trueness, line recovery | 28DAT1 |
| 24.07.14 | Penetration depth, hardness, VWC, smoothness, trueness, line recovery | 35DAT1 |
| 31.07.14 | Penetration depth, hardness, VWC, smoothness, trueness, line recovery | 42DAT1 |
| 08.08.14 | Penetration depth, hardness, VWC, smoothness, trueness, line recovery | 50DAT1 |
| 21.08.14 | Water infiltration rate | 63DAT1 |
| 12.09.14 | Penetration depth, hardness, VWC | 85DAT1 |
| 25.09.14 | Penetration depth, hardness, VWC, smoothness, trueness, line recovery | 1DAT2 |
| 03.10.14 | Penetration depth, hardness, VWC, smoothness, trueness, line recovery | 9DAT2 |
| 09.10.14 | Penetration depth, hardness, VWC, smoothness, trueness, line recovery | 15DAT2 |
| 16.10.14 | Penetration depth, hardness, VWC, smoothness, trueness, line recovery | 22DAT2 |
| 23.10.14 | Penetration depth, hardness, VWC, smoothness, trueness, line recovery | 29DAT2 |
| 30.10.14 | Penetration depth, hardness, VWC, smoothness, trueness, line recovery | 36DAT2 |
| 06.11.14 | Penetration depth, hardness, VWC, smoothness, trueness, line recovery | 43DAT2 |
| 13.11.14 | Penetration depth, hardness, VWC, smoothness, trueness, line recovery | 50DAT2 |
| 20.11.14 | Penetration depth, hardness, VWC, smoothness, trueness, line recovery | 57DAT2 |
| 02.12.14 | Water infiltration rate | 69DAT2 |
| 10.12.14 | Penetration depth, hardness, VWC | 77DAT2 |

VWC = volumetric soil water content

DAT = days after Sandcat treatment

## Assessments

After each Sandcat operation there was an intensive monitoring programme over an eight week period. After the intensive eight week assessments, a less intense monitoring programme was implemented with monthly measurements. The assessments that carried out during the trial were as follows:

### Line recovery

To determine how well Sandcat lines closed, how visible the lines were was assessed on a 1 – 10 scale, where 1 = definite lines visible which have no grass plants growing in them; 5 = lines visible but filled with grass plants or where the grass had grown over the sand and 10 = no visible line at all.

### Surface smoothness and trueness

Smoothness and trueness of the putting surface was measured using the STRI Trueness Meter™. Measurements were made going across the Sandcat lines, as the intention of this measurement was to assess the relative effect on ball roll of the operation. The rationale was that golf balls rolling across the lines would be most susceptible to bobble and snake, rather than balls rolling in-line with the Sandcat grooves.

### Surface hardness

Surface hardness was measured using a 0.5 kg golf Clegg Impact Soil Tester dropped from 0.5 m.

Penetration depth
Penetration depth was measured with a Longchamp Penetrometer. A 1 kg test mass was dropped from 1 m onto a 1 cm² probe. The depth to which the probe is pushed into the ground after each drop of the test mass, for a total of four drops, was recorded. From these data, the initial surface penetration was calculated as the penetration over the first drop. Total penetration was calculated and represented total compaction over the depth of penetration.

Moisture content (to a depth of 60 mm in the field)
Soil moisture was measured in the upper 60 mm of the soil profile using a Theta Probe.

Water infiltration rate
Water infiltration rate was measured using double ring infiltrometers and a falling head method. This gave an indication as to the rate of water movement into the soil under the prevailing soil conditions. Infiltration measurements were made August and December 2014, once the main testing had been completed so that the marks left by the infiltration rings in the turf surface did not affect the smoothness or trueness data.

Assessments were made along a number of transects within each area. Fifteen readings were made in each quarter of the trial area for each parameter to allow statistical analysis.

The measurement programme during the trial is given below:

| Intensive 8 week period after Sandcat operation | Routine monthly monitoring outside of the intensive 8 week period after each Sandcat operation |
|---|---|
| Line recovery | Surface hardness |
| Smoothness and trueness | Volumetric soil water content |
| Surface hardness | Penetration depth |
| Volumetric soil water content | |
| Penetration depth | |

## Results

Penetration depth
Penetration depth is a technique that can be used to give an overall indication of compaction within the soil profile, as well as the relative firmness of the soil in response to soil water retention. Initial penetration depth measured compaction and soil firmness in the upper green profile. During the trial, statistically significant differences were measured on 14 out of 19 assessment dates (Table 1). On these dates, turf treated with the Sandcat had significantly lower initial penetration depth, in comparison to turf where the Sandcat had not be used. These differences were primarily the result of the Sandcat treated turf having significantly lower soil water content, resulting in firmer soil conditions and therefore less penetration. Differences between the Sandcat and the turf not treated with the Sandcat became more consistent and more evident after the second operation and during a wetter period of the year.

Total penetration measured the overall level of compaction and the relative firmness of the soil to a greater depth in the profile. During 2014, there were statistically significant differences among treatments on 9 out of 19 assessment dates (Table 2). The overall trend was for turf treated with the Sandcat to have significantly lower total penetration depth, in comparison to the turf not treated with the Sandcat. The main reason for these differences was the drier soil conditions in the plots treated with the Sandcat.

Surface hardness

After the first Sandcat operation, there were no statistically significant differences between the two treatments (Table 3). However, after the second operation in late September, statistically significant differences were measured on 9 out of 10 assessment dates. On each of these dates, turf treated with the Sandcat had a consistently harder surface. This was the result of the reduced water retention in the turf treated with the Sandcat, with these effects being most evident under the wetter winter conditions.

Volumetric soil water content

Throughout the trial, turf treated with the Sandcat had consistently drier soil conditions and retained less water under wet weather (Table 4). There were statistically significant differences between the Sandcat treatments on 16 out of 19 assessment dates. These differences became more pronounced during periods of wet weather, especially after the second Sandcat operation.

Surface smoothness

Inevitably, running the Sandcat over a turf surface resulted in a less smooth surface, when a golf ball was run at 90° to the sand grooves, in comparison to the turf not treated with the Sandcat (Table 5). However, it was possible to minimise the differences between the treatments around 28 days after the operation was carried out. This resulted from the use of turf rollers, verticutting and top dressing across the trial area to promote a smoother surface. After the second Sandcat operation, it was not possible to have such an intensive remediation programme, as disease pressure was high and to prevent microdochium patch occurring, less intensive remedial operations such of grooming and lighter sand top dressings had to be adopted. As a result, differences in surface smoothness between the Sandcat treatments remained longer during this period of the trial.

Surface trueness

In contrast to surface smoothness, trueness readings from turf treated with the Sandcat tended to have similar, if not lower (truer), values than those measured on the non-Sandcat treated turf (Table 6). On 7 out of 19 assessment dates, turf treated with the Sandcat tended to have less lateral ball movement, in comparison to the untreated turf.

Line recovery

Line recovery was assessed on Sandcat treated turf that have either been treated with Vision Pro or left untreated. A statistically significant difference between the Vision Pro treatments was observed on 11 July (Table 7). On this date, the lines in the turf treated with Vision Pro tended to be less obvious. However, further differences were not observed during the trial.

Water infiltration rate

The use of the Sandcat had a dramatic effect on water infiltration rates (Table 8). Turf treated with the Sandcat consistently had greater than double the water infiltration rate, as compared to turf not treated with the Sandcat.

## Discussion

During 2014, treating the turf in June and September with the Sandcat resulted in drier, firmer, truer turf, and produced a surface that drained significantly quicker. The benefits of the Sandcat became even more evident after the second operation and during the naturally wetter winter months.

The use of the Sandcat did result in slightly less smooth surface immediately after the treatment. However, with appropriate remedial maintenance, such as use of rollers and top dressing, surface smoothness can quickly be re-established to levels similar to those measured in untreated turf. However, the benefits of using the Sandcat to improve long-term agronomic issues such as excessive soil water retention, water infiltration and surface hardness were significant.

For the forthcoming year's operations, it would be better to plan carrying out the Sandcat operations in May and August. The rationale is that the May operation will allow the turf to quickly recover prior to the peak playing season, whilst the August operation will hopefully ensure that the operation is not carried out during a period of high disease pressure. It was noted this year that, with the second Sandcat operation being carried out in late September, when disease pressure was naturally higher, there was a greater risk of disease as a result of the release of nutrient from the oxidation of organic matter, greater potential air entry into the soil, coupled with a naturally high plant pathogen population. This resulted in not being able to follow as intensive a remediation programme after the Sandcat operation in September as was followed in June. If the operation was carried out in August it should be possible to follow this more intensive programme.

It would still be worth investigating the effects of Vision Pro to help speed up line recovery. This time it may be worth applying a preparatory treatment several weeks before the Sandcat operations are carried out. The rationale would be to boost turf health and growth in the treated turf prior to the use of the Sandcat.

In summary, the results from this year's trial highlight consistent and real benefits of using the Sandcat on natural soil greens with underlying agronomic issues. It will be very interesting to the effects of the Sandcat operations over the rest of this winter and into the next growing season.

Table 1. Initial penetration (mm) from untreated plots and plots treated with the Sandcat.

| Treatment | 20.06.14 1DAT1 | 27.06.14 8DAT1 | 04.07.14 15DAT1 | 11.07.14 22DAT1 | 17.07.14 28DAT1 | 24.07.14 35DAT1 | 31.07.14 42DAT1 | 08.08.14 50DAT1 | 12.09.14 85DAT1 |
|---|---|---|---|---|---|---|---|---|---|
| [1] No Sandcat | 18.7 | 23.2 | 12.4 | 19.7 | 27.1 | 16.1 | 23.0 | 19.5 | 27.6 |
| [2] Sandcat | 16.2 | 21.5 | 12.2 | 19.1 | 23.9 | 13.7 | 21.6 | 17.7 | 24.6 |
| | | | | | | | | | |
| P | 0.036 | NS | NS | NS | 0.006 | 0.044 | NS | NS | 0.008 |
| d.f. | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 |

NS = No significant difference

Table 1 continued. Initial penetration (mm) from untreated plots and plots treated with the Sandcat.

| Treatment | 25.09.14 1DAT2 | 03.10.14 9DAT2 | 09.10.14 15DAT2 | 16.10.14 22DAT2 | 23.10.14 29DAT2 | 30.10.14 36DAT2 | 06.11.14 43DAT2 | 13.11.14 50DAT2 | 20.11.14 57DAT2 | 10.12.14 77DAT2 |
|---|---|---|---|---|---|---|---|---|---|---|
| [1] No Sandcat | 30.4 | 30.7 | 32.4 | 33.5 | 33.9 | 35.0 | 34.1 | 36.0 | 35.9 | 37.3 |
| [2] Sandcat | 24.2 | 28.3 | 28.3 | 30.4 | 30.5 | 31.6 | 31.0 | 34.2 | 32.3 | 33.5 |
| | | | | | | | | | | |
| P | <0.001 | 0.014 | <0.001 | <0.001 | <0.001 | <0.001 | 0.003 | <0.001 | 0.003 | 0.003 |
| d.f. | 44 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 |

NS = No significant difference

Table 2. Total penetration (mm) from untreated plots and plots treated with the Sandcat.

| Treatment | 20.06.14<br>1DAT1 | 27.06.14<br>8DAT1 | 04.07.14<br>15DAT1 | 11.07.14<br>22DAT1 | 17.07.14<br>28DAT1 | 24.07.14<br>35DAT1 | 31.07.14<br>42DAT1 | 08.08.14<br>50DAT1 | 12.09.14<br>85DAT1 |
|---|---|---|---|---|---|---|---|---|---|
| [1] No Sandcat | 70.5 | 73.4 | 44.8 | 65.0 | 85.1 | 64.0 | 69.6 | 65.7 | 91.5 |
| [2] Sandcat | 79.3 | 76.8 | 47.8 | 74.2 | 82.5 | 62.4 | 70.0 | 67.1 | 87.0 |
| | | | | | | | | | |
| P | 0.019 | NS | NS | NS | NS | NS | NS | NS | NS |
| d.f. | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 |

NS = No significant difference

Table 2 continued. Total penetration (mm) from untreated plots and plots treated with the Sandcat.

| Treatment | 25.09.14<br>1DAT2 | 03.10.14<br>9DAT2 | 09.10.14<br>15DAT2 | 16.10.14<br>22DAT2 | 23.10.14<br>29DAT2 | 30.10.14<br>36DAT2 | 06.11.14<br>43DAT2 | 13.11.14<br>50DAT2 | 20.11.14<br>57DAT2 | 10.12.14<br>77DAT2 |
|---|---|---|---|---|---|---|---|---|---|---|
| [1] No Sandcat | 89.9 | 95.5 | 94.7 | 98.6 | 97.1 | 98.6 | 95.2 | 97.6 | 100.8 | 97.6 |
| [2] Sandcat | 84.8 | 88.6 | 87.8 | 95.0 | 91.6 | 94.7 | 89.8 | 91.7 | 93.1 | 90.6 |
| | | | | | | | | | | |
| P | 0.041 | 0.009 | 0.008 | NS | 0.022 | NS | 0.029 | 0.009 | 0.007 | 0.017 |
| d.f. | 51 | 58 | 58 | 58 | 46 | 58 | 58 | 58 | 58 | 58 |

NS = No significant difference

Table 3. Hardness (gravities) from untreated plots and plots treated with the Sandcat.

| Treatment | 20.06.14 1DAT1 | 27.06.14 8DAT1 | 04.07.14 15DAT1 | 11.07.14 22DAT1 | 17.07.14 28DAT1 | 24.07.14 35DAT1 | 31.07.14 42DAT1 | 08.08.14 50DAT1 | 12.09.14 85DAT1 |
|---|---|---|---|---|---|---|---|---|---|
| [1] No Sandcat | 89 | 83 | 114 | 108 | 82 | 113 | 92 | 103 | 84 |
| [2] Sandcat | 85 | 80 | 119 | 111 | 83 | 113 | 93 | 100 | 86 |
| | | | | | | | | | |
| P | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| d.f. | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 |

NS = No significant difference

Table 3 continued. Hardness (gravities) from untreated plots and plots treated with the Sandcat.

| Treatment | 25.09.14 1DAT2 | 03.10.14 9DAT2 | 09.10.14 15DAT2 | 16.10.14 22DAT2 | 23.10.14 29DAT2 | 30.10.14 36DAT2 | 06.11.14 43DAT2 | 13.11.14 50DAT2 | 20.11.14 57DAT2 | 10.12.14 77DAT2 |
|---|---|---|---|---|---|---|---|---|---|---|
| [1] No Sandcat | 83 | 80 | 80 | 70 | 73 | 67 | 74 | 66 | 71 | 63 |
| [2] Sandcat | 87 | 85 | 82 | 77 | 79 | 72 | 79 | 74 | 76 | 76 |
| | | | | | | | | | | |
| P | <0.001 | <0.001 | NS | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| d.f. | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 |

NS = No significant difference

Table 4. Volumetric soil water content (%) from untreated plots and plots treated with the Sandcat.

| Treatment | 20.06.14 1DAT1 | 27.06.14 8DAT1 | 04.07.14 15DAT1 | 11.07.14 22DAT1 | 17.07.14 28DAT1 | 24.07.14 35DAT1 | 31.07.14 42DAT1 | 08.08.14 50DAT1 | 12.09.14 85DAT1 |
|---|---|---|---|---|---|---|---|---|---|
| [1] No Sandcat | 34.5 | 29.7 | 22.0 | 26.5 | 36.2 | 26.3 | 33.7 | 25.3 | 35.4 |
| [2] Sandcat | 29.7 | 31.2 | 18.4 | 27.0 | 34.1 | 23.9 | 31.6 | 22.4 | 33.4 |
| | | | | | | | | | |
| P | 0.002 | NS | <0.001 | * | 0.044 | 0.002 | NS | 0.027 | 0.009 |
| d.f. | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 |

NS = No significant difference

* Data skewed and therefore parametric analysis no possible

Table 4 continued. Volumetric soil water content (%) from untreated plots and plots treated with the Sandcat.

| Treatment | 25.09.14 1DAT2 | 03.10.14 9DAT2 | 09.10.14 15DAT2 | 16.10.14 22DAT2 | 23.10.14 29DAT2 | 30.10.14 36DAT2 | 06.11.14 43DAT2 | 13.11.14 50DAT2 | 20.11.14 57DAT2 | 10.12.14 77DAT2 |
|---|---|---|---|---|---|---|---|---|---|---|
| [1] No Sandcat | 36.2 | 40.4 | 40.4 | 42.1 | 39.4 | 42.0 | 39.0 | 44.0 | 40.1 | 48.7 |
| [2] Sandcat | 32.5 | 34.1 | 35.7 | 36.4 | 34.6 | 37.2 | 33.1 | 39.6 | 35.3 | 40.4 |
| | | | | | | | | | | |
| P | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| d.f. | 58 | 58 | 58 | 49 | 58 | 50 | 50 | 58 | 58 | 58 |

Table 5. Smoothness (mm/m) from untreated plots and plots treated with the Sandcat.

| Treatment | 20.06.14 1DAT1 | 27.06.14 8DAT1 | 04.07.14 15DAT1 | 11.07.14 22DAT1 | 17.07.14 28DAT1 | 24.07.14 35DAT1 | 31.07.14 42DAT1 | 08.08.14 50DAT1 |
|---|---|---|---|---|---|---|---|---|
| [1] No Sandcat | 39.6 | 38.9 | 40.1 | 37.0 | 43.3 | 37.1 | 32.5 | 38.2 |
| [2] Sandcat | 45.6 | 47.1 | 51.7 | 40.1 | 44.4 | 38.4 | 33.3 | 39.3 |
| | | | | | | | | |
| P | <0.001 | <0.001 | <0.001 | <0.001 | NS | <0.009 | 0.045 | NS |
| d.f. | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 |

NS = No significant difference

Table 5 continued. Smoothness (mm/m) from untreated plots and plots treated with the Sandcat.

| Treatment | 29.09.14 5DAT2 | 03.10.14 9DAT2 | 09.10.14 15DAT2 | 16.10.14 22DAT2 | 23.10.14 29DAT2 | 30.10.14 36DAT2 | 06.11.14 43DAT2 | 13.11.14 50DAT2 | 20.11.14 57DAT2 |
|---|---|---|---|---|---|---|---|---|---|
| [1] No Sandcat | 53.6 | 37.2 | 38.7 | 39.1 | 41.4 | 39.3 | 34.2 | 36.4 | 36.4 |
| [2] Sandcat | 63.9 | 40.0 | 45.9 | 46.0 | 47.0 | 46.2 | 39.9 | 41.4 | 39.9 |
| | | | | | | | | | |
| P | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| d.f. | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 |

Table 6. Trueness (mm/m) from untreated plots and plots treated with the Sandcat.

| Treatment | 20.06.14<br>1DAT1 | 27.06.14<br>8DAT1 | 04.07.14<br>15DAT1 | 11.07.14<br>22DAT1 | 17.07.14<br>28DAT1 | 24.07.14<br>35DAT1 | 31.07.14<br>42DAT1 | 08.08.14<br>50DAT1 |
|---|---|---|---|---|---|---|---|---|
| [1] No Sandcat | 13.0 | 13.8 | 17.1 | 13.7 | 17.0 | 17.7 | 14.2 | 16.5 |
| [2] Sandcat | 10.1 | 12.0 | 18.0 | 13.7 | 16.1 | 16.1 | 14.0 | 16.2 |
| | | | | | | | | |
| P | <0.001 | 0.016 | NS | NS | 0.024 | <0.001 | NS | NS |
| d.f. | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 |

NS = No significant difference

Table 6 continued. Trueness (mm/m) from untreated plots and plots treated with the Sandcat.

| Treatment | 25.09.14<br>5DAT2 | 03.10.14<br>9DAT2 | 09.10.14<br>15DAT2 | 16.10.14<br>22DAT2 | 23.10.14<br>29DAT2 | 30.10.14<br>36DAT2 | 06.11.14<br>43DAT2 | 13.11.14<br>50DAT2 | 20.11.14<br>57DAT2 |
|---|---|---|---|---|---|---|---|---|---|
| [1] No Sandcat | 20.1 | 18.4 | 14.8 | 17.6 | 18.0 | 19.3 | 14.7 | 19.3 | 17.8 |
| [2] Sandcat | 19.9 | 17.1 | 14.8 | 16.3 | 17.9 | 18.4 | 15.5 | 18.1 | 16.9 |
| | | | | | | | | | |
| P | NS | NS | NS | 0.025 | NS | 0.011 | NS | 0.014 | NS |
| d.f. | 58 | 58 | 58 | 58 | 58 | 49 | 48 | 58 | 58 |

Table 7. Line recovery (1-10 score) from plots Sandcat treated turf with and without application of Vision Pro after the operation.

| Treatment | 20.06.14 1DAT1 | 27.06.14 8DAT1 | 04.07.14 15DAT1 | 11.07.14 22DAT1 | 17.07.14 28DAT1 | 24.07.14 35DAT1 | 31.07.14 42DAT1 | 08.08.14 50DAT1 |
|---|---|---|---|---|---|---|---|---|
| [1] No Vision Pro | 1.0 | 2.1 | 3.9 | 4.7 | 7.5 | 7.9 | 8.7 | 9.6 |
| [2] Vision Pro | 1.0 | 2.0 | 3.9 | 5.7 | 7.7 | 7.7 | 8.7 | 9.4 |
| | | | | | | | | |
| P | NS | NS | NS | 0.01 | NS | NS | NS | NS |
| d.f. | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 |

NS = No significant difference

Table 7 continued. Line recovery (1-10 score) from plots Sandcat treated turf with and without application of Vision Pro after the operation.

| Treatment | 25.09.14 1DAT2 | 03.10.14 9DAT2 | 09.10.14 15DAT2 | 16.10.14 22DAT2 | 23.10.14 29DAT2 | 30.10.14 36DAT2 | 06.11.14 43DAT2 | 13.11.14 50DAT2 | 20.11.14 57DAT2 |
|---|---|---|---|---|---|---|---|---|---|
| [1] No Vision Pro | 6.3 | 6.8 | 6.8 | 7.4 | 8.3 | 8.8 | 8.9 | 9.5 | 9.3 |
| [2] Vision Pro | 6.2 | 6.8 | 6.8 | 7.3 | 8.2 | 8.6 | 8.9 | 9.3 | 9.4 |
| | | | | | | | | | |
| P | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| d.f. | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 |

Table 8. Water infiltration rate (mm $hr^{-1}$) from untreated plots and plots treated with the Sandcat.

| Treatment | 21.08.14 63DAT1 | 02.12.14 69DAT2 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| [1] No Sandcat | 17.7 | 8.0 | | | | | | |
| [2] Sandcat | 38.9 | 22.6 | | | | | | |
| | | | | | | | | |
| P | <0.001 | <0.001 | | | | | | |
| d.f. | 20 | 21 | | | | | | |

## Photographs

Plate 1: Completion of first SandCat operation

Plate 2: Brushing of sand into turf

Plate 3: Comparison of brushed and unbrushed turf

Plate 4: Turf after initial remedial works carried out

Plate 5: Close up of brushed turf

Plate 6: Surface water ponding on aerated turf – no ponding was observed on SandCat treated turf.

Plates 1-6: Photographs from SandCat treated turf and that receiving only aeration.

| | |
|---|---|
|  |  |
| Plate 7: SandCat treated turf after 15 days | Plate 8: Close up of SandCat treated turf 15DAT |
|  |  |
| Plate 9: Conventionally treated turf after 15 days | Plate 10: Water infiltration measurement |

Plates 7-10: Photos of turf recovery after SandCat operation.