

**FINAL REPORT ON THE EFFECTS
OF OVER SEEDING RATE ON THE
APPEARANCE OF HEAVILY WORN
PERENNIAL RYEGRASS TURF
FOLLOWING RENOVATION**

For

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SUMMARY

A trial to evaluate the effects of different over seeding rates on the appearance of a heavily worn perennial ryegrass sward (simulating an end of season winter sports pitch) was established at the STRI on 20 May 2004 for DLF-Perryfields Ltd. In the study five different perennial ryegrass seed rates were used (12.5 g m^{-2} , 25 g m^{-2} , 50 g m^{-2} , 75 g m^{-2} and 100 g m^{-2}). Additionally a treated seed (*iseed*) was also included at a rate of 25 g m^{-2} to allow a comparison of treated seed against untreated seed sown at standard rate to be made. The initial effects of over seeding, at the different rates, on live ground cover and turf quality were assessed weekly for the first nine weeks of the trial. The longer term effects of the different over seeding rates, under simulated football wear conditions, were then assessed for a further nine months until the end of the trial in May 2005.

This work has shown that increasing over seeding rates above the standard rate (25 g m^{-2}) could help to produce a well grassed and visually appealing surface more quickly, particularly when the rate was increased to four times the standard rate. Although, the benefits of this, the highest seed rate, only lasted for the first four weeks after renovation using twice and three times the above standard rate also had a positive effect on both live ground cover and turf quality throughout the renovation period. Once artificial wear started the benefits on live ground cover of higher than normal seeding rates started to become less apparent. It was found that once wear began the highest rate treatment had less ground cover and a poorer turf quality than the treatments sown at 50 g m^{-2} and 75 g m^{-2} .

By the start of 2005, four months after the start of artificial wear, no significant differences were found in the amount of live ground cover among any of the over seeding treatments. However, increasing seed rate to twice and three times standard rate did have a positive effect of the turf quality.

The *iseed* treated seed had no positive effects on ground cover or turf quality throughout the duration of the trial. However, during the initial establishment phase some negative effects were noted. The *iseed* treated seed performed less well in terms of ground cover and turf quality than the untreated seed sown at the same rate. As the trial progressed under the artificial wear conditions, the *iseed* was not found to perform significantly less well

than any of the other over seeding treatments in terms of ground cover and turf quality. However, it did have the lowest score of all the over seeded treatments during the later stages of the trial.

The un-seeded control was found to perform significantly less well in terms of live ground cover and turf quality than any of the over seeding treatments throughout the duration of the trial.

INTRODUCTION

Over seeding is an important part of the renovation programme for intensively used winter games pitches. This study, funded by DLF-Perryfields Ltd, examined the effects of different over seeding rates on the speed of recovery of a heavily worn perennial ryegrass sward. The objectives were:

- To examine the speed of recovery, over an initial eight-week period, of a heavily worn perennial ryegrass sward over-seeded with a perennial ryegrass mixture sown at five different seed rates (12.5 g m⁻², 25 g m⁻², 50 g m⁻², 75 g m⁻² and 100 g m⁻²) compared to an un-seeded control.
- To compare the use of a treated seed (*iseed*) against an untreated seed sown at 'standard seed rate' (25 g m⁻²).
- To examine the longevity of any treatment effects over a 10-month period under simulated football wear conditions.

MATERIALS AND METHODS

Experimental design and management

A trial to evaluate the appearance of a heavily worn perennial ryegrass sward over-seeded with a perennial ryegrass mixture, sown at five different seed rates 12.5 g m⁻², 25 g m⁻², 50 g m⁻², 75 g m⁻² and 100 g m⁻² and an un-seeded control was established in the STRI trial grounds (NGR SE 095 391; altitude 200 m) on 20 May 2004. A treated seed (*iseed*) was also included at a rate of 25 g m⁻² to allow a comparison of treated seed against untreated seed sown at 'standard rate' to be made, Table 1. The trial was sown in a randomised block design with five complete replications, giving a total of 35 plots to assess. Individual plots measured 1.25 m x 1.25 m.

TABLE 1

Over seeding rates used in the 20 May 2004 sown DLF-Perryfields trial to examine the effects of over seeding rate on the speed of recovery of heavily worn perennial ryegrass turf.

Treatment	Over seeding rates
1	no over seeding control
2	over seed at half standard rate 12.5 g m ⁻²
3	over seed at standard rate 25 g m ⁻²
4	over seed at 2 x standard rate 50 g m ⁻²
5	over seed at 3 x standard rate 75 g m ⁻²
6	over seed at 4 x standard rate 100 g m ⁻²
7	over seed at standard rate (25 g m ⁻²) using <i>iseed</i> treated seed

Prior to initiating the work a suitable area of perennial ryegrass turf was selected within the STRI's experimental ground. This was then intensively worn using the STRI's differential slip wear machine fitted with football stud rotors to simulate an area after it had been

subjected to hard domestic/football pitch usage. Figure 1. Following wear and prior to over seeding, renovation work was carried out on the area using a Sisis Auto Seeder. Making four passes in different directions with the Auto Seeder created a fine seedbed suitable for over seeding into. Figure 2.

Following normal practice fertiliser (8 : 12 : 8, N : P₂O₅ : K₂O) was applied to the experimental area (35 g m⁻²) prior to seeding. All plots were then sown by hand at the appropriate rate and a top dressing added at a rate of 4 kg m⁻². Full details of trial management are given in Table 2. Twice weekly mowing commenced on 8 June 2004 at a cutting height of 50 mm. The height of cut was reduced on 11 June to 40 mm. Further reductions in mowing height to 30 mm and then 25 mm were made over the next four weeks to achieve a final mowing height of 20 mm on 16 July 2004. Mowing continued twice weekly at this height until 8 October 2004. From 18 October 2004 until the 5 April 2005 the trial was mown as and when necessary. A weekly mowing regime was



FIGURE 1

Left, wear being applied using the STRI's differential slip wear machine fitted with football rotors. Right, a well-worn surface after intensive wear with the differential slip wear machine.



FIGURE 2

Renovation of the trial area using the Sisis Auto Seeder to produce a fine seedbed prior to over seeding.

reintroduced on 5 April 2005. Weekly mowing continued until 3 May 2005. From this date to the end of the trial on 17 May 2005 the trial was mown twice weekly. All clipping were boxed off the trial area.

Three and a half months after over seeding, on 24 August 2004, artificial, football type, wear commenced on the trial area. This continued throughout the normal soccer season until the end of the trial on 19 May 2005.

TABLE 2

Details of trial management for the 20 May 2004 sown DLF-Perryfields trial to examine the effects of over seeding rate on the speed of recovery of heavily worn perennial ryegrass turf.

Fertiliser applications	Rate	Date
(N:P ₂ O ₅ :K ₂ O)		
8:12:8 (seedbed fertiliser)	35 g m ⁻²	19 April 2004
12:6:6	33 g m ⁻²	22 June 2004
12:6:6	33 g m ⁻²	13 August 2004
12:6:6	22 g m ⁻²	12 November 2004
12:6:6	35 g m ⁻²	29 April 2005
Aeration		
100 mm solid tines		20 October 2004
Hand forking		21 October 2004
Paths Dagged		29 October 2004
Slitting		11 November 2004
Slitting		27 January 2005
Slitting		2 March 2005
Slitting		23 March 2005
Watering		
Oscillating sprinkler 1.5 hours duration		18 May 2004
Oscillating sprinkler 30 minutes duration		20 May 2004
Oscillating sprinkler 30 minutes duration		21 May 2004
Oscillating sprinkler 40 minutes duration		24 May 2004
Oscillating sprinkler 15 minutes duration		25 May 2004
Oscillating sprinkler 40 minutes duration		26 May 2004
Oscillating sprinkler 20 minutes duration x2		27 May 2004
Oscillating sprinkler 20 minutes duration x2		28 May 2004
Oscillating sprinkler 20 minutes duration		7 June 2004
Impact sprinkler 1 hour duration		9 June 2004
Impact sprinkler 1 hour duration		10 June 2004
Oscillating sprinkler 1 hour duration		17 June 2004

Experimental assessments

Set out below are descriptions of the measurements and assessments that were made on the trial between May 2004 and May 2005. These measurements and assessments were all made in accordance with the appropriate STRI Standard Operating Procedures. Copies of all relevant STRI Standard Operating Procedures are presented in Appendix 1. Grass cover assessments were made using two different methods. A subjective visual assessment with results being expressed as an estimated percentage of live grass cover (SOP no. 1B1199 method A); and a measure of relative grass cover using the STRI's reflectance ratio meter (SOP no. 301499). The reflectance ratio meter measures the relative intensities of reflected light at wavelengths of 650 and 750 nm. As green vegetation affects the reflectance of light in the 650 nm wave band but not in the 750 nm band, the ratio of the reflected light at these

two wavelengths is proportionally affected by the amount of live vegetation in the field of view. Grass cover was assessed, using both methods, weekly from 27 May to 23 July 2004 and then monthly from August 2004 until May 2005. Turf quality was assessed, by subjective visual assessment using a 1 – 10 scale (SOP no. 1B0703), weekly from 1 June to 23 July 2004 and then monthly from August 2004 until May 2005. One assessment of red thread disease was made on 12 August 2004 using a standardised subjective scoring system (SOP no. 301098).

RESULTS AND DISCUSSION

The measurements/assessments made between May 2004 and May 2005 are presented in tabular form below. All data collected were analysed using an appropriate analysis of variance. Statistically significant variation, at the 5% level of probability ($P < 0.05$), is shown by the calculation of a least significant difference (LSD). Data that were not found to be statistically significant (ns) have also been included in the presentation of the results. Photographs were taken throughout the duration of the trial. A pictorial comparison of the five over seeding rates and one control taken during weeks 2, 3, 5 and 8 (June and July 2004) and then in August, September, November and December 2004 and from January to May 2005 can be found in Appendix 2. A treated seed, *iseed*, was also included in the trial. This was sown at the 'standard rate' of 25 g m^{-2} . A photographic comparison between the *iseed* and the untreated seed sown at 25 g m^{-2} can be found in Appendix 3. These photographs were taken at the same time as those in Appendix 2.

Grass cover

Visual assessment of ground cover

Visual assessments of live ground cover were made weekly for the first nine weeks of the trial (27 May, 1, 8, 15, 22 and 29 June and 6, 14 and 23 July 2004). Assessments were then made monthly from August 2004 until the end of the trial in May 2005. Artificial, football type, wear began on 24 August 2004 and continued throughout the winter period until the end of the trial in May 2005

The results for the live ground cover assessments made during the first nine weeks after over seeding (27 May to 23 July) are presented in Table 3. The greatest differences in over seeding rates were found during this initial nine-week period and consequently this will be dealt with separately from the wear phase of the trial from August 2004 to May 2005.

TABLE 3

Variation in live ground cover (estimated percentage) among treatments for the 20 May 2004 sown DLF-Perryfields over seeding trial. The assessments presented were made weekly from 27 May to 23 July 2004.

Treatment	27/5/04	1/6/04	8/6/04	15/6/04	22/6/04	29/6/04	6/7/04	14/7/04	23/7/04
100 g m ⁻²	2.2	64.0	86.4	92.6	95.2	97.8	98.0	97.8	98.0
75 g m ⁻²	1.4	50.0	76.0	88.2	91.2	96.2	96.6	96.8	97.0
50 g m ⁻²	1.4	38.4	48.6	72.0	79.6	89.0	91.6	92.8	94.0
25 g m ⁻²	1.6	17.6	29.4	43.4	60.0	81.6	85.4	87.6	89.6
25. g m ⁻² <i>iseed</i>	1.6	13.6	20.6	29.6	42.0	67.0	77.4	78.8	79.8
12.5 g m ⁻²	3.0	13.2	20.2	32.4	43.4	72.0	80.2	82.0	82.8
Control	2.0	4.0	4.2	6.0	7.8	21.0	26.2	32.6	34.4
LSD	ns	9.1	8.1	7.4	7.7	8.4	5.4	7.0	7.8

On the first assessment date, seven days after over seeding, no significant differences were found among any of the treatments. When the second assessment of live ground cover was made 12 days after over seeding on 1 June 2004 marked differences were found among the treatments. The higher seed rates (100 g m^{-2} , 75 g m^{-2} and 50 g m^{-2}) all had a significantly higher live ground cover than the standard and half standard rates (25 g m^{-2} and 12.5 g m^{-2} respectively). Significant differences were found among each of the three higher rate treatments with the 100 g m^{-2} having a significantly higher ground cover than the 75 g m^{-2} which had a significantly higher live ground cover than the 50 g m^{-2} . Although the standard seed rate (25 g m^{-2}) had a higher live ground cover than the half standard rate it was not found to be significantly higher than either this treatment or the *iseed* treated seed sown at 25 g m^{-2} . The control (no over seeding) had significantly less live ground cover than all the over seeded plots. At this time a close to linear relationship was found between over seeding rate and live ground cover. This is illustrated in Figure 3.

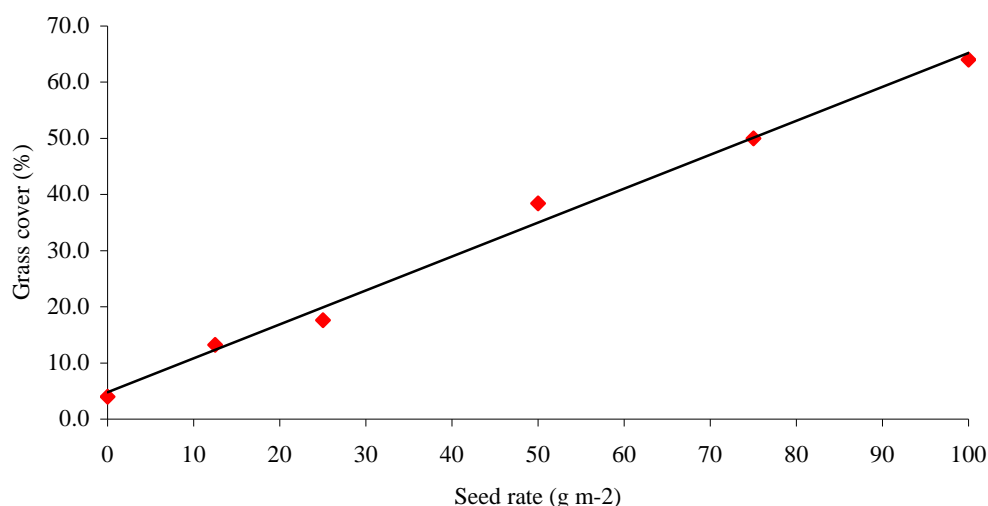


FIGURE 3

Graph to show the relationship between seed rate and percentage live ground cover for the assessment made during week two (assessment date 1 June 2004) for the five over seeding rates and one control (zero rate) in the 20 May 2004 sown DLF-Perryfields over seeding trial.

When the third assessment of live ground cover was made, 18 days after over seeding, on 8 June 2004 a very similar situation was found to that on 1 June. Again the three higher seed rates all had a significantly higher live ground cover than the standard and half standard rates. They were also all significantly different from each other with live ground cover decreasing with seed rate. However, when this assessment was made the standard seed rate was found to have a significantly higher live ground cover than the half standard rate and the *iseed* treated seed. It is interesting that the *iseed* treated seed, although sown at the standard rate of 25 g m^{-2} was performing less well than the untreated seed sown at the same rate. Again the control had a significantly lower live ground cover than all the over seeding treatments.

The assessments made on 15 and 22 June 2004 showed very similar results. Although the highest seed rate was still found to have the greatest live ground cover it was only found to be slightly above that of the 75 g m^{-2} rate. No significant differences were found between these two rates. Although the 50 g m^{-2} over seeding rate was found to have a significantly

lower live ground cover than the two highest rate treatments it had significantly more live ground cover than the standard and half standard treatments. As when the assessment was made on 8 June the standard rate was found to have a significantly higher live ground cover than the half standard rate and the *iseed* treated seed. The un-seeded control had a significantly lower live ground cover than all the other treatments. The relationship between live grass cover and seed rate for the assessment made on the 22 June is illustrated in Figure 4. This shows a marked positive effect of increasing seed rate on grass cover from the control (no over seeding) up to 50 g m⁻². The benefit on live ground cover of increasing the over seeding rate above 50 g m⁻² is much less pronounced with no significant difference between the two highest rate treatments.

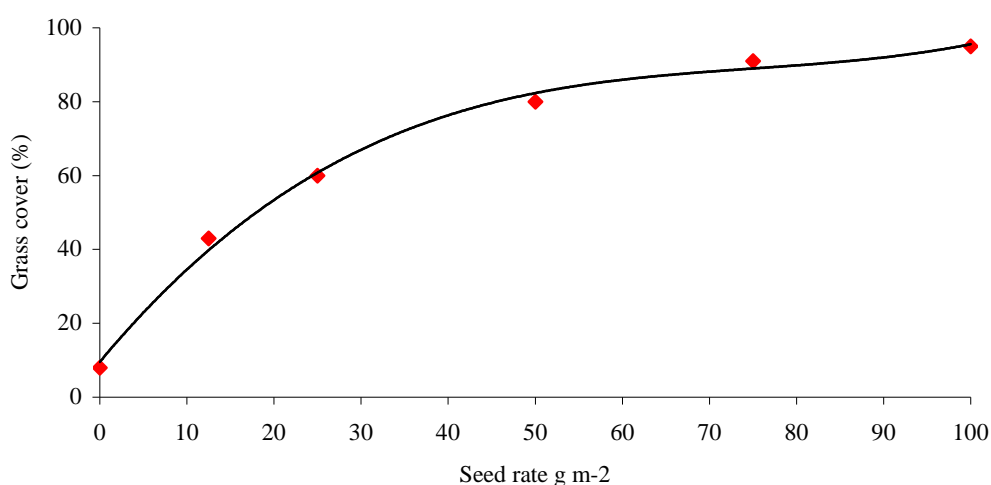


FIGURE 4

Graph to show the relationship between seed rate and percentage live ground cover for the assessment made during week five (assessment date 22 June 2004) for the five over seeding rates and one control (zero rate) in the 20 May 2004 sown DLF-Perryfields over seeding trial.

When the assessment was made on 29 June 2004, six weeks after sowing, very little difference was found in the amount of live ground cover for the two highest rate treatments. Both were found to have over 96 percent live ground cover at this time. Although the plots over sown at 75 g m⁻² had more live ground cover than those seeded at 50 g m⁻², this difference was not found to be significant. There was no significant difference found between the standard rate for over seeding and the twice-standard rate of 50 g m⁻². Again the *iseed* treated seed was found to have a significantly lower live ground cover than the untreated seed sown at the standard rate. In fact the *iseed* treated seed had a lower live ground cover than the half standard rate treatment (12.5 g m⁻²), although this difference was not significant. Again, as on the previous four assessment dates the control had a significantly lower live ground cover than all the other treatments.

The final three weekly assessments were made on the 6, 14 and 23 July. The results were all very similar on each of these assessment dates. The amount of live ground cover for the three highest rates of over seeding decreased from the 100 g m⁻² to the 75 g m⁻² and again to the 50 g m⁻², however, on the 14 and 23 July no significant differences were found among these three over seeding rates. On 6 July there was no significant difference between the 100 g m⁻² and the 75 g m⁻² over seeding rates, however, the 50 g m⁻² rate had significantly less live ground cover than the 100 g m⁻² rate. On all three-assessment dates

the above standard rate treatments had a live ground cover of above 90 percent. The *iseed* treated seed (sown at standard rate) had a significantly lower live ground cover, when each of the assessments was made in weeks 7, 8 and 9, than the untreated seed sown at the standard rate. Although the *iseed* treated seed had a lower live ground cover than the seed sown at half standard rate (12.5 g m⁻²) on each of the above three assessment dates this difference was not found to be significant. The un-seeded control had a significantly lower live ground cover than all the other treatments on all three of the assessment dates in July. The relationship between live ground cover and over seeding rate, during week eight of the trial, is illustrated in Figure 5.

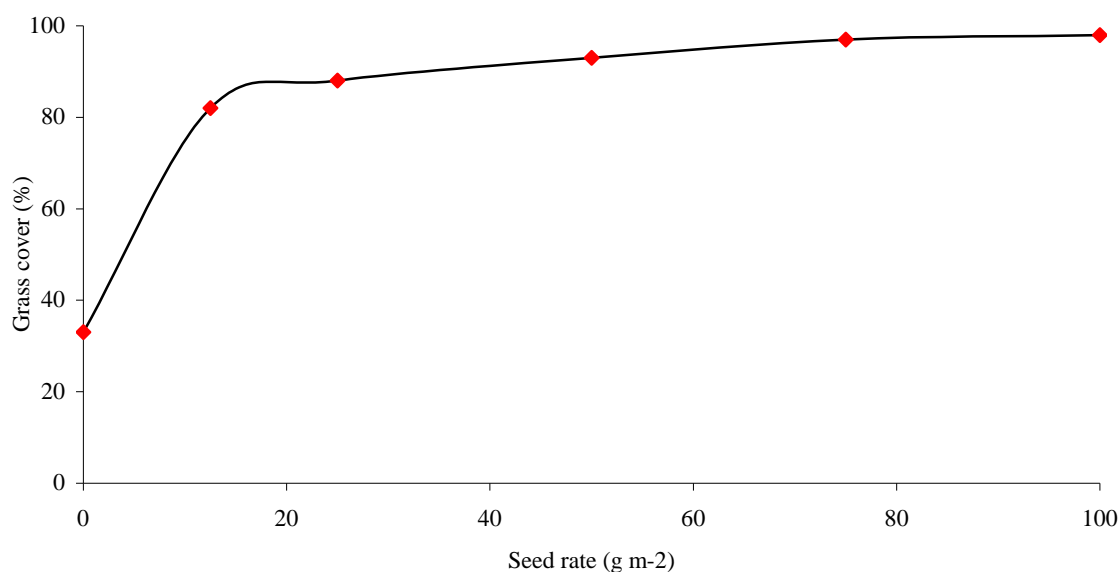


FIGURE 5

Graph to show the relationship between seed rate and percentage live ground cover for the assessment made during week eight (assessment date 14 July 2004) for the five over seeding rates and one control (zero rate) in the 20 May 2004 sown DLF-Perryfields over seeding trial.

It can be seen from this graph that the percentage of live ground cover increased by nearly 50 percent between the un-seeded control and the 12.5 g m⁻² over seeding rate. In contrast the increase between the standard over seeding rate (25 g m⁻²) and the highest rate of 100 g m⁻² was then less than 16 percent.

A graphical representation of all the changes in live ground cover described above is presented in Figure 6.

The relationship between over seeding rate and the time taken to achieve 80 percent live ground cover is presented in Figure 7. This illustrates clearly that increasing the over seeding rate well above what would be considered a standard rate of 25 g m⁻² can have a pronounced effect on the speed at which a sward achieves a high degree of ground cover. The highest rate of over seeding used for the trial was 100 g m⁻², four times standard rate. The plots sown at this rate achieved 80 percent live ground cover twice as quickly as those over seeded at the standard rate of 25 g m⁻².

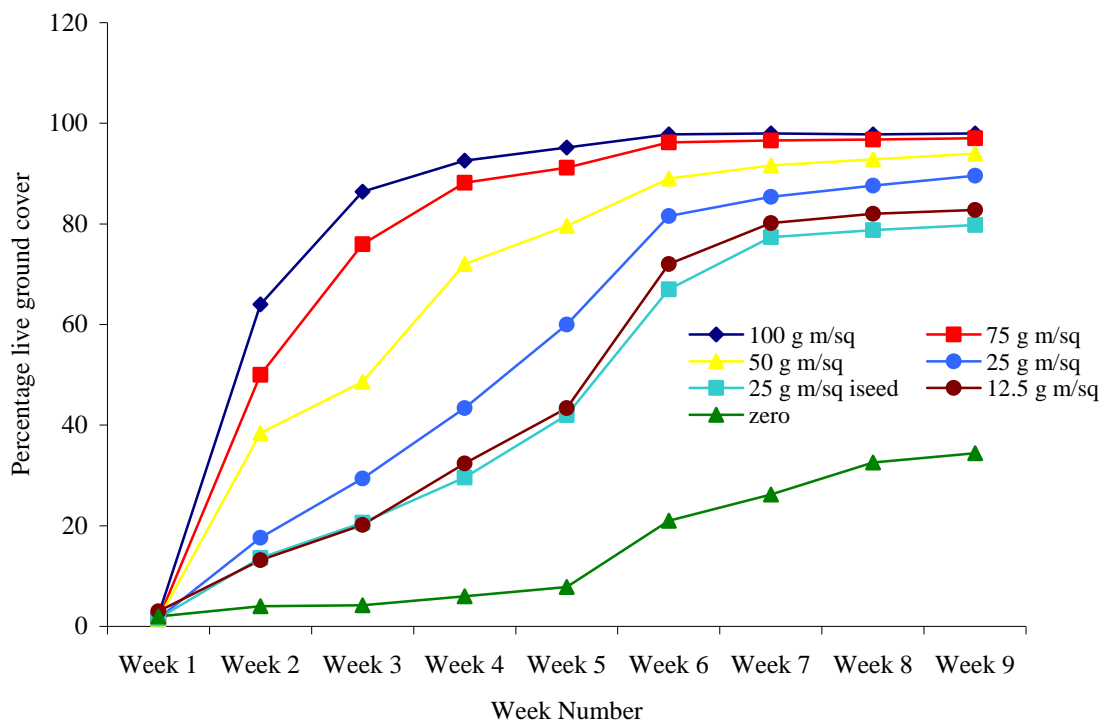


FIGURE 6

Graph to show the change in percentage of live ground cover, for assessments made weekly, from 27 May to 23 July 2004 for the seven treatments in the 20 May 2004 sown DLF-Perryfields over seeding trial.

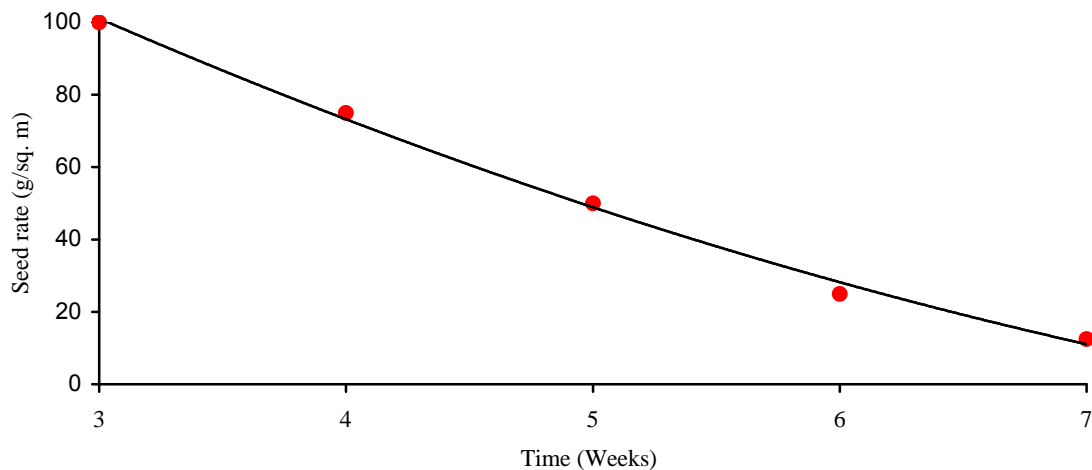


FIGURE 7

Graph to show the time taken to achieve 80 % ground cover for the five over seeding rates in the 20 May 2004 sown DLF-Perryfields over seeding trial.

The results for the live ground cover assessments made from August 2004 until May 2005 are presented in Table 5.

TABLE 5

Variation in live ground cover (estimated percentage) among treatments for the 20 May 2004 sown DLF-Perryfields over seeding trial. The assessments presented were made monthly from August 2004 to May 2005. It should be noted that artificial football type wear began on the trial on 24 August 2004.

Treatment	8/04	9/04	10/04	11/04	12/04	1/05	2/05	3/05	4/05	5/05
100 g m ⁻²	97.7	93.2	75.8	74.2	54.6	53.6	40.0	36.0	18.6	47.0
75 g m ⁻²	97.2	93.8	76.4	77.8	59.6	60.2	44.0	40.2	25.4	49.6
50 g m ⁻²	95.2	91.8	73.0	77.0	58.4	60.4	46.6	41.6	23.0	53.6
25 g m ⁻²	92.7	89.4	67.4	76.0	54.2	59.2	42.8	38.8	22.8	55.8
25. g m ⁻² <i>iseed</i>	85.7	85.2	59.4	66.4	48.2	55.4	44.0	39.0	24.2	50.4
12.5 g m ⁻²	86.8	86.8	61.8	71.8	52.6	60.0	50.0	42.2	28.2	58.2
Control	47.3	52.0	30.2	37.4	22.4	28.0	25.8	14.4	9.8	26.8
LSD	7.0	5.3	7.7	8.6	9.7	9.4	10.7	8.0	8.4	11.4

During this period of the trial artificial, football type, wear was applied regularly using the STRI differential slip wear machine, (Figure 8). Please note that the assessment made in August 2005 was carried out before the artificial wear began on 24 August 2004. Wear was applied throughout the winter period weather conditions permitting.



FIGURE 8

Artificial football type wear being applied to the trial using the STRI differential slip wear machine.

The assessments of live ground cover made during August and September 2004 showed no significant differences among the four treatments sown at standard and above standard seed rate using untreated seed. There was also no significant difference found among the untreated seed sown at standard rate (25 g m⁻²), the *iseed* treated seed sown at standard rate and the half standard rate sown seed. However, the control had a significantly lower live ground cover than all the other treatments on both assessment dates.

In October 2004 the 75 g m⁻² over seeding rate had the highest live ground cover, however, it was not significantly greater than the 100 g m⁻² or the 50 g m⁻² rates. The untreated seed sown at standard rate had a significantly higher live ground cover than the *iseed* treated seed sown at the same rate. The un-seeded control was again found to have a significantly lower live ground cover than all the other treatments. The affects of wear on the trial, together with reduced growth started to become more apparent in this month. The results

in Table 5 show that the amount of live ground cover for all treatments had declined from that found during September.

The assessments made in November and December 2004 showed very similar results. The 75 g m⁻² and 50 g m⁻² over seeding rates had the highest live ground cover in both months. However, it was not found to be significantly higher than that for the 100 g m⁻², 25 g m⁻² and 12.5 g m⁻² over seeding rates. Although the *iseed* treated seed had a lower live ground cover than all the other treatments, except the untreated control, during both November and December it was not found to have a significantly lower live ground cover than the 100 g m⁻² or the 12.5 g m⁻² over seeding rate treatments in both months. The total amounts of live ground cover found for each treatment generally declined between November and December. This was to be expected due to the application of the football type wear.

Live ground cover assessments were made during the first five months of 2005. Very similar results were found on each of the assessment dates. In January, February, March and May no significant differences were found among any of the over seeding treatments. However, the un-seeded control was found to have a significantly lower live ground cover than the over seeding treatments. In April 2005 no significant differences were found among the 75 g m⁻², 50 g m⁻², 25 g m⁻² (*iseed* treated seed and untreated seed) and 12.5 g m⁻² treatments. In contrast the highest over seeding rate had a lower live ground cover than the other over seeding treatments but it was only significantly lower than the 12.5 g m⁻² rate. Again the un-seeded control had a significantly lower live ground cover than all the other treatments. There are some interesting points to note in the results found during this period. The amount of live ground cover for each of the treatments declined over the first four months of the year due to the application of wear using the STRI differential slip wear machine. An increase in the amount of live ground cover was found in May, despite the continued application of artificial wear to the trial. This was probably due to increased temperatures leading to greater grass growth. It is also interesting to note that the results in Table 5 show that when the live ground cover assessments were made in February, March, April and May 2005 the plots over seeded at half the standard seed rate of 12.5 g m⁻² had the highest live ground cover. In contrast the plots over seeded at 100 g m⁻² were found to have the least live ground cover (within the over seeding treatments) when each of these assessments was made. It is possible that the lower seeding rate had a positive effect on recovery when conditions improved during the Spring of 2005.

Figure 9 shows a graphical representation of the changes in live ground cover described above from August 2004 until the end of the trial in May 2005.

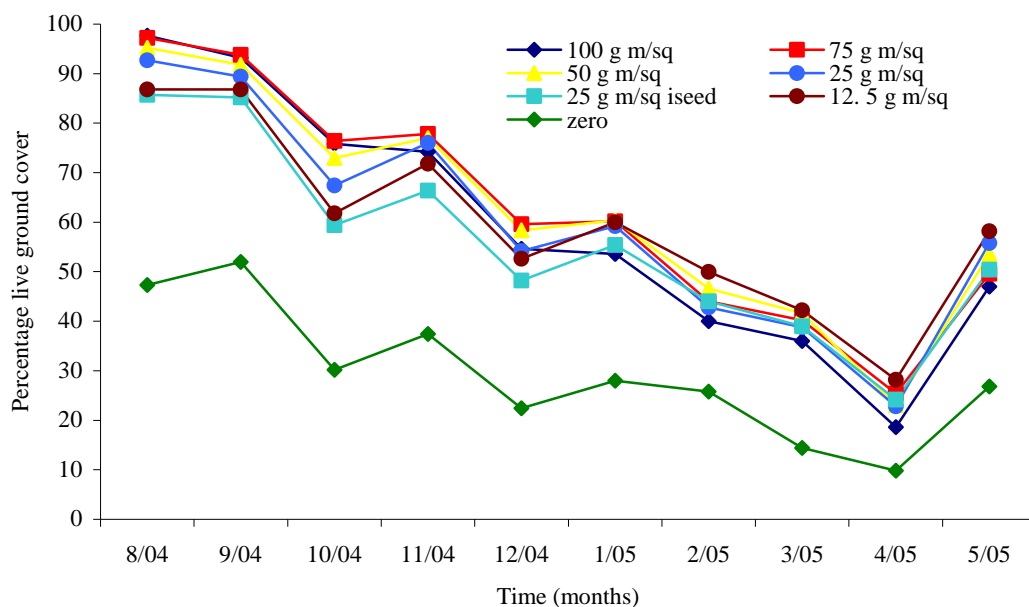


FIGURE 9

Graph to show the change in percentage of live ground cover, for assessments made monthly from August 2004 to May 2005 for the seven treatments in the 20 May 2004 sown DLF-Perryfields over seeding trial.

Reflectance ratio (relative grass cover)

Reflectance ratio measurements were made at the same time as the visual assessment of live ground cover was carried out. As for the live ground cover assessments these measurements were made weekly for the first nine weeks of the trial, from 27 May to 23 July 2004. Measurements were then made monthly from August 2004 until May 2005.

The results for the reflectance ratio measurements made during the first nine weeks after over seeding (27 May to 23 July) are presented in Table 6. The greatest differences in over seeding rates were found during this initial nine-week period and consequently this will be dealt with separately from the wear phase of the trial from August 2004 to May 2005.

TABLE 6

Reflectance ratio values for the 20 May 2004 sown DLF-Perryfields over seeding trial. The measurements presented were made weekly from 27 May to 20 July 2004

Treatment	27/5/04	1/6/04	8/6/04	15/6/04	22/6/04	29/6/04	6/7/04	13/7/04	20/7/04
100 g m ⁻²	3.2	75.6	86.8	83.0	73.6	84.6	78.2	67.6	66.8
75 g m ⁻²	3.2	69.2	85.8	82.0	75.0	84.2	78.8	67.8	66.8
50 g m ⁻²	2.4	59.4	81.0	76.0	68.6	83.4	79.4	72.4	69.0
25 g m ⁻²	2.8	50.4	76.6	69.6	67.6	81.8	79.4	76.6	71.8
25. g m ⁻² iseed	2.8	46.2	71.0	67.2	68.8	80.8	78.8	73.2	70.2
12.5 g m ⁻²	3.2	47.8	70.6	67.2	67.2	82.2	80.0	76.0	71.0
Control	3.0	42.0	59.0	44.0	52.6	72.2	72.4	63.8	64.0
LSD	ns	8.6	3.8	8.4	6.4	5.2	3.8	5.9	4.9

On the first assessment date seven days after over seeding, no significant differences were found among any of the treatments. When the second measurement of relative grass cover was made on 1 June 2004 significant differences were found among the treatments. The higher rates of over seeding, 100 g m⁻² and 75 g m⁻² had a significantly higher relative grass

cover than all the other treatments. Although the twice-standard seed rate of 50 g m⁻² had a significantly lower relative grass cover than the two highest over seeding rates (100 g m⁻² and 75 g m⁻²) it was significantly higher than the standard rate (treated and untreated) half standard rate and control. No significant differences were found between the un-seeded control and the standard and half standard seed rates at this time.

When the measurements of relative grass cover were made on 8 and 15 June 2004 a similar situation was found on both assessment dates. The highest over seeding rate of 100 g m⁻² had the highest relative grass cover, however, this was not significantly higher than the 75 g m⁻² rate. On 8 June the 50 g m⁻² over seeding rate was found to have a significantly higher relative grass cover than the standard sowing rate (25 g m⁻²) using untreated seed. A week later on 15 June no significant difference was found between these two treatments. No significant difference was found between the *iseed* treated seed sown at standard rate and the untreated seed sown at half standard rate on either of the two assessment dates. The un-seeded control had a significantly lower live ground cover than all the other treatments on both of the dates described.

When the relative grass cover was measured on 22 June 2004 the plots over seeded at 75 g m⁻² were found to have the highest relative grass cover although no significant difference was found between this and the highest rate of 100 g m⁻². At this time there was very little difference among the 50 g m⁻², the 25 g m⁻², untreated and *iseed* treated seed, and the 12.5 g m⁻² treatments. The un-seeded control had a significantly lower relative grass cover than all the other treatments.

Six and seven weeks after over seeding, when the relative grass cover was measured on both 29 June and 6 July 2004 a very similar situation was found. No significant difference was found among any of the over seeded treatments for either assessment date. Indeed, the differences between all the treatments at this time were only small. As on the three previous assessment dates the un-seeded control had a significantly lower live ground cover than all the over seeding treatments.

The final two weekly measurements of relative grass cover were made on 13 and 20 July 2004. Interestingly on both assessment dates the highest relative grass cover scores were found for the untreated seed sown at standard rate (25 g m⁻²). However, this treatment was not found to be significantly different from the twice standard over seeding rate (50 g m⁻²) the *iseed* treated seed sown at 25 g m⁻² and the 12.5 g m⁻² over seeding rate. On 13 July 2004 the un-seeded control had a significantly lower live ground cover than all the other treatments, however, when the measurement was made on 20 July no significant difference was found between the control and the two highest rate treatments.

The results for the reflectance ratio measurements made monthly from August 2004 until May 2005 are presented in Table 7.

Looking at these data shows that from August 2004 until April 2005 the general trend was for the scores for relative grass cover to decline, as would be expected, due to the application of wear to the trial area. The scores for May show an increase in relative grass cover once the spring growth started to have a greater effect on grass cover than that of the artificial wear treatments.

The results for the seven months from August 2004 until February 2005 show that no significant differences were found among any of the over seeding treatments during this period. The un-seeded control was, however, found to have a significantly lower score for relative grass cover than all the other treatments on each occasion that assessments were made.

TABLE 7

Reflectance ratio values for the 20 May 2004 sown DLF-Perryfields over seeding trial. The measurements presented were made monthly from August 2004 to May 2005. It should be noted that artificial football type wear began on the trial on 24 August 2004.

Treatment	8/04	9/04	10/04	11/04	12/04	1/05	2/05	3/05	4/05	5/05
100 g m ⁻²	80.8	67.4	56.4	54.8	58.2	67.4	40.0	34.4	33.2	59.0
75 g m ⁻²	81.0	69.0	56.0	54.4	60.2	69.2	39.2	35.4	35.8	58.2
50 g m ⁻²	81.2	68.6	55.8	55.2	57.2	67.0	38.6	35.8	32.8	59.2
25 g m ⁻²	81.9	70.2	57.6	58.0	58.0	68.4	40.6	38.8	36.0	63.4
25. g m ⁻² <i>iseed</i>	81.0	69.4	55.4	57.2	59.4	69.8	42.0	40.0	37.6	60.4
12.5 g m ⁻²	81.2	70.4	59.4	59.0	60.4	71.8	46.0	44.2	43.8	65.8
Control	76.7	59.0	44.2	45.8	46.8	58.2	32.0	29.4	32.6	56.0
LSD	1.5	6.4	5.8	6.6	6.2	5.7	7.1	7.7	ns	ns

When the relative grass cover was measured in March 2005, six months after ‘football type’ wear was started on the trial area the half standard over seeding rate of 12.5 g m⁻² was found to have the highest score for relative grass cover. However, no significant differences were found between this over seeding rate and the standard rate of 25 g m⁻² for either the un-treated or *iseed* treated seed. Also no significant differences were found among the three highest rate treatments at this time. The un-seeded control had a significantly lower relative grass cover than the standard and half standard over seeding rates but was not found to be significantly different to the three highest rate treatments.

When the final two measurements of relative grass cover were made in April and May 2005 the plots over seeded at half the standard seed rate were found to have the highest relative ground cover, however, the data for these two assessment dates was not found to be significant.

Turf Quality

Turf quality assessments were made weekly from 1 June until 23 July 2004 and then monthly from August 2004 until May 2005. These results and an overall mean for the turf quality assessments made from 1 June to 23 July are presented in Table 8. The results for the assessments made monthly (August 2004 to May 2005) together with an overall mean, are presented in Table 9. As with both the visual assessment of ground cover and the reflectance ratio (relative grass cover) measurements the results from the weekly assessments of turf quality will be described separately from those made monthly during the period that artificial, football type, wear was applied to the trial.

The mean value for assessments made from 1 June to 23 July shows that overall the two highest over seeding rates (100 g m⁻² and 75 g m⁻²) had the highest turf quality. Although the plots over seeded at 50 g m⁻² had a significantly lower turf quality than the two highest over seeding rates, they were found to be significantly more attractive than the standard over seeding rate of 25 g m⁻² using untreated seed. The untreated seed sown at the standard rate had a significantly higher visual turf quality than the *iseed* treated seed sown at the same rate. No significant difference was found between the plots sown at the half standard

seed rate (12.5 g m⁻²) and the *iseed* treated seed sown at the standard rate. The un-treated control had a significantly lower visual turf quality than all the other treatments.

TABLE 8

Turf quality scores (1 = poor, 10 = very good) for the 20 May 2004 sown DLF-Perryfields over seeding trial. The assessments presented were made weekly from 1 June to 23 July 2004. These are ranked from highest to lowest using the mean score.

Treatment	1/6/04	8/6/04	15/6/04	22/6/04	29/6/04	6/7/04	14/7/04	23/7/04	Mean
100 g m ⁻²	6.6	8.4	8.2	8.0	8.2	7.8	7.6	7.4	7.8
75 g m ⁻²	5.0	7.2	7.4	7.6	8.0	7.8	7.6	7.2	7.2
50 g m ⁻²	4.6	6.0	6.0	6.2	7.2	7.2	7.4	7.2	6.5
25 g m ⁻²	3.0	4.0	4.0	4.8	6.2	5.2	6.0	5.6	4.9
12.5 g m ⁻²	2.6	3.4	2.8	3.8	5.0	3.4	4.6	3.8	3.7
25 g m ⁻² <i>iseed</i>	2.6	3.4	2.4	3.4	4.2	3.8	4.2	4.0	3.5
zero	1.2	1.0	1.0	1.0	1.4	1.0	1.2	1.2	1.1
LSD	0.9	0.6	0.7	1.2	1.0	1.0	0.7	1.0	0.6

Looking at the turf quality assessments for the individual weeks. On the first two assessment dates, 1 and 8 June 2004 the plots over seeded at 100 g m⁻² had the highest turf quality and were found to be significantly more attractive than any of the other treatments on both of these assessment dates. On the first assessment date (1 June 2004) no significant difference was found between the 75 g m⁻² and the 50 g m⁻² over seeding rates, however, when the assessments were made on 8 June 2004 the 75 g m⁻² over seeding rate was found to be significantly more attractive than the 50 g m⁻² over seeding rate. On both dates no significant differences were found between the standard over seeding rate of 25 g m⁻² the standard rate using *iseed* treated seed and the half standard seed rate of 12.5 g m⁻². The un-seeded control was found to have a significantly lower turf quality than all the other treatments.

When the turf quality assessment was made on 15 June 2004 the highest over seeding rate had the best turf quality. Turf quality declined as the over seeding rate decreased with significant differences being found between each rate. The half standard rate of 12.5 g m⁻² had a higher turf quality than the standard rate *iseed* treated seed. The un-seeded control had a lower turf quality than all the other treatments.

TABLE 9

Monthly turf quality scores (1 = poor, 10 = very good) for the 20 May 2004 sown DLF-Perryfields over seeding trial. The assessments presented were made monthly from August 2004 to May 2005. These are ranked from highest to lowest using the mean score. It should be noted that artificial 'football type' wear began on 24 August 2004.

Treatment	8/04	9/04	10/04	11/04	12/04	1/05	2/05	3/05	4/05	5/05	Mean
75 g m ⁻²	7.7	6.2	6.6	6.4	6.4	7.0	6.0	6.2	5.4	5.4	6.3
50 g m ⁻²	7.0	6.0	6.6	6.0	6.0	7.2	6.2	6.2	4.8	5.8	6.1
100 g m ⁻²	7.7	6.0	6.6	5.8	5.6	5.8	5.4	5.0	5.0	5.2	5.7
25 g m ⁻²	5.7	4.2	6.0	5.2	5.6	6.6	5.8	5.6	5.0	5.4	5.5
12.5 g m ⁻²	3.8	4.0	4.8	5.2	5.4	6.4	6.8	5.6	5.4	5.4	5.3
25g m ⁻² <i>iseed</i>	4.2	4.0	5.2	5.2	5.0	6.0	5.2	4.8	4.4	3.4	4.7
zero	1.2	1.2	1.4	1.4	2.0	2.6	2.0	1.6	1.8	1.8	1.7
LSD	0.9	1.1	1.0	1.1	1.3	1.6	2.3	1.6	2.0	1.4	1.0

The fourth turf quality assessment was made on 22 June 2004. At this time no significant difference was found between the two highest rate treatments. However, these were found

to have a significantly higher turf quality than the 50 g m⁻² over seeding rate. The untreated seed sown at standard rate, although poorer in turf quality than the twice standard rate treatment, was found to have significantly higher turf quality than the *iseed* treated seed sown at standard rate and the 12.5 g m⁻² over seeding rate. The un-seeded control was, as on the previous assessment dates, found to have a significantly poorer turf quality than the over seeding treatments.

The assessments made on 29 June, 6, 14 and 23 July 2004 all showed very similar results. No significant differences were found among any of the higher rate treatments, however, they did have a significantly higher turf quality than the standard sowing rate of 25 g m⁻² using untreated seed. This treatment in turn had a significantly higher turf quality than both the half standard seed rate and *iseed* treated seed treatments. The un-seeded control had a significantly lower turf quality than all the over seeding treatments.

Looking at the overall mean for the assessments of turf quality made monthly from August 2004 until May 2005 it can be seen that overall the 75 g m⁻² over seeding rate had the best turf quality (Table 9). However, it was not found to be significantly more attractive than any of the other plots over seeded using untreated seed. The *iseed* treated seed sown at 25 g m⁻² was found to have a mean score for the 10 month period that was significantly lower than that for the three above standard rate treatments. It didn't, however, have a significantly lower score for turf quality than the untreated standard over seeding rate or the half standard over seeding rate treatments. The un-seeded control had a significantly lower score for turf quality than all the other treatments.

When the scores for the individual months are looked at separately a similar situation was found when the assessments were made in both August and September. In these months no significant difference was found among the three above standard rate treatments. In August 2004 the 25 g m⁻² treatment scored significantly better than the half standard over seeding rate and *iseed* treated seed sown at standard rate. However, by September 2004, once artificial football type wear, had started to be applied no significant difference was found between the treated and un-treated seed sown at standard rate and the half standard rate treatment.

In October 2004 no significant differences were found among the 100 g m⁻², 75 g m⁻², 50 g m⁻², and 25 g m⁻² treatments. Also no significant difference was found between the *iseed* treated seed and the half standard rate treatment at this time. The untreated control again scored very poorly for turf quality.

In November 2004 the 75 g m⁻² over seeding rate had the highest score for turf quality, however, it was not found to be significantly more attractive than the other two above average over seeding rate treatments. Interestingly, at this time, it was the only treatment that had a significantly higher score for turf quality than the standard over seeding treatment. Again the un-seeded control had a significantly lower score for turf quality than the over seeding treatments.

In December 2004, the 75 g m⁻² over seeding rate was again found to have the highest turf quality. However, it was not found to be significantly higher than any of the other over seeding treatments that used untreated seed. The un-seeded control had the poorest turf quality and was found to be significantly less attractive than all the other treatments.

For the first four months of 2005 the differences in visual turf quality among all the over seeding treatments were only small with none of the differences being found to be significant. The un-seeded control had a significantly lower turf quality than all the over seeding treatments throughout this four month period.

When the final assessment of visual turf quality was made in May 2005 the plots over seeded at 50 g m⁻² were found to be the most attractive. However, there were no significant differences between this treatment and all the other over seeding treatments. Indeed the differences in turf quality among the over seeding treatments from 12.5 g m⁻² to 100 g m⁻² were only found to be very slight. The *iseed* treated seed sown at the standard seeding rate of 25 g m⁻² was found to have a significantly lower turf quality than all the other over seeding treatments. The plots sown with *iseed* treated seed were, however, found to have a higher visual turf quality than the un-seeded control, which was significantly less attractive than all the other treatments.

Red Thread

In August 2004 the trial was found to have red thread disease. This was scored using a standardised scoring system where 0 = no disease and 13 = 100 percent disease. The results for the red thread assessment are presented in Table 10.

TABLE 10

Red thread values assessed on 12 August 2004 using a standardised scoring system (0 = no disease, 13 = 100 % disease) for the 20 May 2004 sown DLF-Perryfields over seeding trial. The results have been ranked from most to least disease.

Treatment	12/8/04
75 g m ⁻²	4.6
100 g m ⁻²	4.3
50 g m ⁻²	3.6
25 g m ⁻²	3.2
12.5 g m ⁻²	2.9
25. g m ⁻² <i>iseed</i>	2.6
Control	1.4
<i>LSD</i>	1.8

The two highest rates of over seeding were found to have the greatest amount of red thread. However, this was not found to be significantly greater than the amount found on the 50 g m⁻², 25 g m⁻² and 12.5 g m⁻² treatments. Although the *iseed* treated seed was found to have less incidence of red thread than the other over seeding treatments it was only found to be significantly lower than the highest rate of infection on the 75 g m⁻² treatment. As would be expected the un-seeded control, which had a lower ground cover than the over seeding treatments, was found to have the lowest incidence of red thread disease.

CONCLUSION

This study examined if increasing normal over seeding rates could increase speed of recovery and visual quality of a heavily worn perennial ryegrass sward. The effects of over seeding were also compared against a control, which was not over seeded. The effects of the increased over seeding rates on wear tolerance over a 10 month period, that was timed to coincide with the football season, were then monitored. A treated seed *iseed* was also included in the trial, sown at the standard rate of 25 g m⁻².

Increasing over seeding rates during the renovation of worn perennial ryegrass turf dramatically increased the speed of establishment and turf quality of the sward. During the establishment phase there was a direct relationship between seed rate and turf quality. The higher seed rates markedly reduced the time required to achieve a surface that would be deemed fit for use. The density and uniformity of sward produced at the end of the establishment phase was also improved by increasing the normal seed rates.

Artificial 'football' type wear was applied from 24 August 2004 and continued throughout the winter until the end of the trial in May 2005. Once the wear treatments started to have an effect (three to four months after the start of wear) the highest over seeding rate was found to have lower ground cover and turf quality in comparison with some of the other seeding rates. It is interesting to note that as the winter progressed and the effects of wear on the trial became increasingly apparent, the half standard over seeding rate (12.5 g m⁻²) was found to have the highest ground cover. It is likely that lower plant density at the start of wear influenced the durability of individual plants. As a result, the bigger plants in the lower density treatment were able to tolerate more wear. In this high wear study it appears that a point was reached where the benefits of plant size started to outweigh the higher plant density. This may not have been the case if wear had been less intensive. It is our view that the benefits of seeding rate will vary at different times of the season and will be influenced by the intensity of wear applied. Further studies that combined seeding rates and different degrees of wear may be warranted.

Overall variation among seed rates was markedly less than the difference observed between the over seeding treatments and the un-seeded control. In this study the un-seeded control failed to reach acceptable standards by the start of the wear treatments and was significantly poorer than all other treatments during wear. This clearly demonstrated that over seeding is necessary to aid recovery after wear.

The use of *iseed* treated seed was not found to have any positive effect on ground cover and turf quality in this study. This treatment also appeared to delay establishment in comparison with the untreated seed in this investigation.

Overall this experiment demonstrated that increasing over seeding rate by two to three times the standard rate could produce a well grassed and visually attractive sward more quickly than over seeding at the standard rate.

QUALITY STATEMENT

I confirm that this report is a true representation of the original data collected and that the Standard Operating Procedures referred to in the STRI Manual of Standard Operating Procedures, and those relevant to data collection, data preparation, archiving of data and preparation of reports have been implemented in full.

Signed:

Report Checked by:

Final version checked and reviewed by:

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APPENDIX 1

STRI STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURE NO. 1B1199 (4 pages)

DETERMINATION OF GROUND COVER

FOREWORD

This standard operating procedure is based upon a draft European Standard in preparation by Technical Committee CEN/217, Surfaces for sports areas.

[1] Scope

This standard operating procedure specifies three methods of test for the determination of ground cover of natural turf.

[2] Terms and Definitions

The proportion of ground cover occupied by the perpendicular projection of live grass material above it.

[3] Principle

Three methods of test are given. Method A is a visual subjective assessment of ground cover using no measuring device. Method B uses a sampling grid to give a more systematic assessment of ground cover. Method C uses a point quadrat for when objective data are required or where a detailed assessment of species composition is needed.

In all three methods, an observer assesses the proportion of ground cover including:

- a) live grass, (this includes healthy (green) and senescent (yellow) leaf tissue together with the living stem material, which can be a variety of colours depending on the grass species).
- b) weeds;
- c) moss;
- d) dead matter and bare ground;

The procedure can be used to measure the live grass ground cover and/or ground cover for individual plant species.

[4] Procedure

Ensure that the sward height is within the range appropriate for the given sport.

Note: The amount of cover which is recorded is dependent on the length of grass. If the sward height is higher than the value for the given sport, mow the turf before assessment. On longer turf and if the grass blades are lying in a procumbent position because of mowing or rolling, brush the test area to achieve a more usual upright position for the grass blades. If the sward height is lower than the value for the given sport, do not proceed with the determination.

[4.1 Method A. Visual assessment of ground cover

4.1.1 Procedure

With the observer standing upright directly adjacent to the test area, estimate by eye the proportion of sports surface occupied by living plant tissue, dead matter and the bare

ground and if required, the proportion covered by particular plant species. Record only living plant tissue as ground cover. Record dead matter and bare ground separately, if required. Estimate the cover visible by the upright observer. Disregard overlap of living plant tissue, i.e. do not multiple count.

Note: An area quadrat (similar to that described in Method B (below), but not necessarily many subdivisions), may be used to define the sampling area.

Unless otherwise specified, assess at least five randomly chosen sampling test areas on sports surfaces of less than 100 m², assess 5–10 test areas as appropriate on sports surfaces of 100 m² to 1000 m² and assess 10-15 test areas on sports surfaces of 1000 m² to 5000 m². Subdivide larger sports areas and test each as above.

4.1.2 Expression of results

Express the results as the estimated percentages of live grass tissue and, if required, give the estimated ground cover for individual plant species.

4.2 Method B. Assessment of ground cover by frame quadrat

4.2.1 Apparatus

Frame between 0.75 m x 0.75 m and 1.0 m x 1.0 m internal dimensions divided into 100 smaller squares (each subdivision representing 1% of the total area) using string, cord or thin wire as shown in Fig. 1.

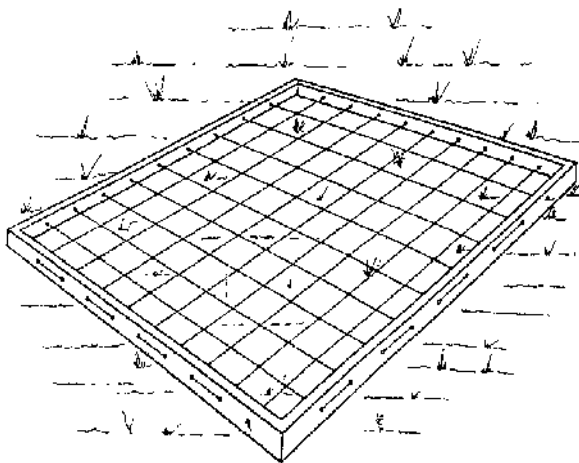


FIGURE 1. Frame for estimating ground cover.

4.2.2 Procedure

Depending on whether the cover components to be counted are smaller or larger than the frame subdivisions, refer to 4.2.2.1 or 4.2.2.2. With the observer standing upright, directly adjacent to the test area, estimate by eye the proportion of sports surface occupied by living plant tissue, dead matter and bare ground. Estimate the percentage of small weed plants or scattered spots of bare ground by the method described in 4.2.2.1. Assess the general distribution of plant cover as compared with extensive bare areas or the areas occupy by large weeds, moss patches, etc. as described in 4.2.2.2.

4.2.2.1 Cover components less than subdivision size

Estimate how many components would be required to fill a subdivision (1% of the frame), then count the number of cover components in the whole area being examined (making due estimation for any overlap which occurs) and from that, calculate the total percentage within the frame.

4.2.2.2 Cover components of subdivision size or larger

Count how many subdivisions in the frame are wholly or more than half filled by the component being assessed. All subdivisions less than half-filled are ignored as 'empty'. With 100 subdivisions the 'full' and 'empty' subdivisions are assumed to balance out with adequate accuracy, so that 'full' subdivisions can be used as a basis for the required percentage figure.

4.2.2.3 Number of frame placings

Unless otherwise specified, make at least five random placings of the frame on areas of less than 100 m², take 5–10 placings as appropriate on areas of 100 m² to 1000 m² and take 10–15 placings at random for areas of 1000 m² to 5000 m². Large areas should be subdivided into two or more areas for testing.

4.2.2.4 Expression of results

Express the results as the estimated percentages of total live grass tissue and, if required, give the estimated ground cover for individual plant species.

4.3 Method C. Assessment of ground cover by point quadrat

4.3.1 Apparatus

Optical point quadrat (see Figure 2). The apparatus consists of a horizontal frame with two rows each of 10 steel pins fixed 50 mm apart within rows and 20 mm between rows.

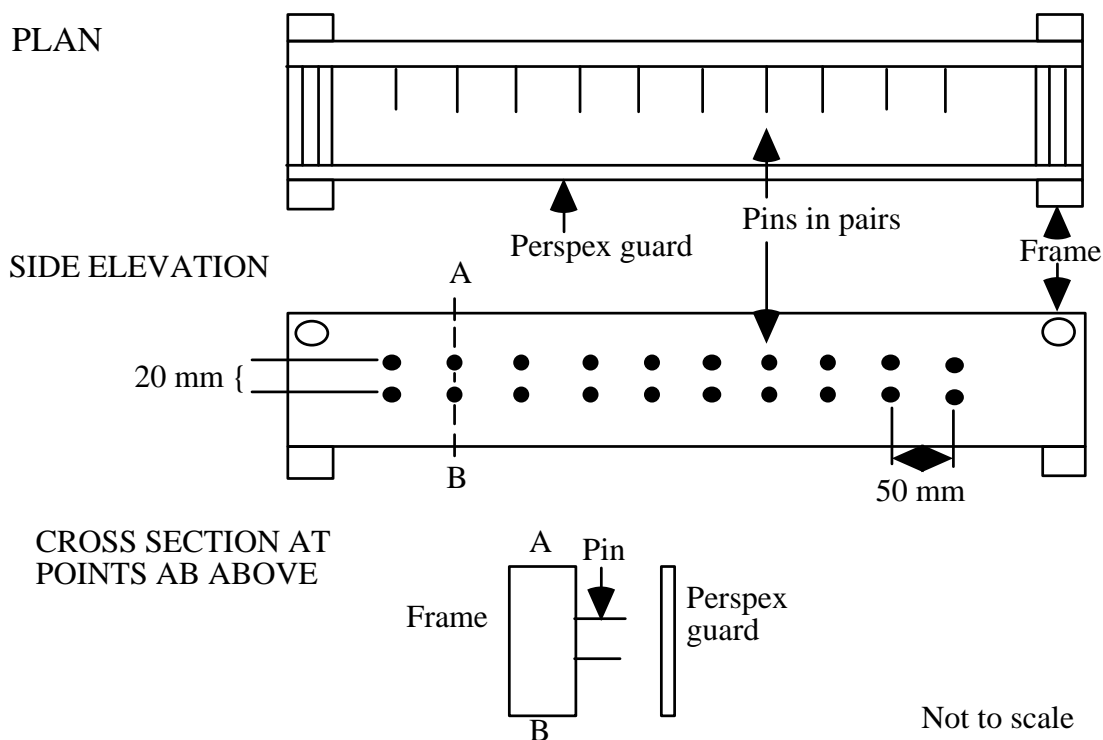


FIGURE 2. Optical point quadrat for ground cover measurement.

4.3.2 Procedure

Lay the frame on the turf and ensure that the bottom row of pins is at least 10 mm above the uppermost grass blades, using supports if necessary to raise the frame. Align by eye the tips of each pair of pins to identify the point to be sampled. At each point record what is directly beneath the tips, i.e. species of grass, weed, dead matter or bare ground. Continue until the frame is completed.

Unless otherwise specified, record information from 30 randomly placed frames on areas less than 100 m², 30–70 frames as appropriate on areas of 100 m² to 1000 m² and 70–100 frames for areas of 1000 m² to 5000 m². Large areas should be subdivided into two or more areas for testing.

4.3.3 Expression of results

Express the results as the measured percentages of total live grass tissue. The individual percentage of each grass species (live material only), weed, moss, dead matter and bare ground shall also be given, if required.

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STANDARD OF OPERATING PROCEDURE NO. 301499 (1 page)

ASSESSMENT OF REFLECTANCE RATIO

[1] Scope

This standard operating procedure specifies the method of assessment of reflectance ratio.

[2] Apparatus

Reflectance Ratio Meter

The meter operates on the principle that the spectral reflectance of bare soil and green vegetation differ. The reflectance ratio meter measures the relative intensities of the reflected light at wavelengths of 650 and 750 nm.

As green vegetation affects the reflectance of light in the 650 nm wave band but not in the 750 nm band, the ratio of the reflected light at these two wave lengths is proportionally affected by the amount of vegetation in the field of view.

[3] Procedure

The machine shall be set to zero using a clean soil area or a black reflective surface. The maximum range should then be set using an area of healthy turf. The range chosen should be in the order of 0 (bare soil) to 80 or 90 for the upper end of the area on which measurements are to be made. Care should be taken to ensure that the upper range does not exceed 100. Measurements on the experimental plots can then be made. It should be noted that changes in ambient light levels can affect the readings made and as such measurements made under light conditions which vary between cloud and direct sunlight will be of little value.

Where there is only small variation in ground cover the ratio may more strongly reflect variation in colour.

[4] References

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STANDARD OPERATING PROCEDURE NO. 1B0703 (1 page)

VISUAL ASSESSMENT OF TURF QUALITY

[1] Scope

This standard operating procedure specifies methods for assessing the visual quality of sports and amenity turf.

[2] Principle

Turf quality is determined by subjective visual assessment using a 1 to 10 scale. Factors taken into account are sward density, uniformity, turf colour, grass cover, weed content and disease and pest invasion.

[3] Procedure

One of two assessment methods shall be used depending on whether there is a need to define the overall quality and acceptability of turf or whether it is desirable to score visual differences which are apparent among treatments but are not necessarily linked to one particular use.

(a) *Assessment to define the quality and acceptability of turf*

The turf is assessed on a 1 to 10 visual scale where a score of 1 represents very poor turf quality and a score of 10 signifies very good turf quality. A value of 5 represents turf that is just acceptable and values below 5 shall be used if turf quality is not considered acceptable.

(b) *Subjective assessment of observed variations among grass cultivars, species and mixtures*

Individual plots will be assessed on a 1 to 10 scale (1 = very poor, 10 = very good). For each assessment a score of 5 will be used to describe plots which could be placed in the middle of the ranking order for that particular assessment. Scores below 5 should be given to plots which fall below this average and above 5 for those which are observed to have greater visual appeal. For each assessment the maximum range between 1 and 10 which can be reasonably scored should be used.

Two or more observers shall be used, except under unusual circumstances (e.g. external visits with only one observer present) or with written approval by the relevant head of division.

Each sampling area is assessed once by each assessor on each occasion. Where two or more individuals are carrying out the assessment, each should obtain a unique score by acting independently.

[4] Expression of results

Where two or more individuals carry out assessment, the mean turf quality value is calculated for each test area.

NOTE:

This is a copy based on an electronic format for inclusion in reports.

The definitive and signed copy can be viewed at the STRI.

STANDARD OF OPERATING PROCEDURE NO. 301098 (1 page)

DISEASE ASSESSMENT

[1] Scope

This standard operating procedure describes the methods used for disease assessments on cultivar evaluation trials.

[2] Procedure

Severity of disease is scored differently depending on the type of disease. Diseases are classified as either patch type (e.g. red thread, dollar spot, fusarium) or diffuse type (e.g. mildew, rusts and leaf spots).

For patch type diseases a standardised subjective scoring system may be used. In this system the area affected is estimated by comparing each plot with a series of disease score cards which have a known area shaded. This system scores plots on a 0 to 13 scale (0=no disease, 1=0.02%, 2=0.05%, 3=0.10%, 4=0.50%, 5=1.0%, 6=3.0%, 7=5.0%, 8=10%, 9=20%, 10=40%, 11=60%, 12=80% and 13=100% of the plot affected). Half scores are used where the severity of the disease appears to lie between two scores.

The occurrence of patch type diseases, particularly seedling diseases, may also be scored using a frame quadrat which has been divided into 100 equal sub-divisions. To do this the quadrat is laid on each of the plots to be assessed and the number of sub-divisions which contain any disease counted.

If patch type diseases were found in more than 70% of the 100 sub divisions in a number of plots in the assessment the severity of disease may be estimated differently. In such cases a subset of 20 sub-divisions per quadrat would be used with disease levels in each sub division being estimated as follows: zero disease = 0; less than 25% disease = 1; 25-50% disease = 2; 50-75% disease = 3; 75-100% disease = 4 and 100% disease = 5. The accumulated score per quadrat would be then multiplied by 5 to give an estimate of percentage disease cover per plot.

The severity of diffuse type diseases is assessed either visually on a 1 to 10 scale (1=no disease; 10=severe infection affecting most leaves) or by one of the following methods:

- (a) Using a dropping point quadrat. This is done by scoring the presence or absence of disease on the first leaf touched. A minimum number of 50 but preferably more points (100) should be counted per plot.
- (b) Disease assessment using randomly selected shoots. The severity of the disease is scored by making counts of the presence of the particular disease being assessed on the two youngest fully emerged leaves of randomly selected shoots from each plot. In this case between 10 and 20 shoots should be examined per plot. The total number of disease counts for each leaf examined and the overall total for each plot should be recorded.

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APPENDIX 2

PHOTOGRAPHS OF EACH OF THE FIVE OVER SEEDING RATE TREATMENTS (12.5 G M⁻², 25 G M⁻², 50 G M⁻², 75 G M⁻² AND 100 G M⁻²) & THE UN-SEEDED CONTROL TAKEN ON THE FOLLOWING ASSESSMENT DATES

2 JUNE 2004

8 JUNE 2004

22JUNE 2004

14 JULY 2004

11 AUGUST 2004

23 SEPTEMBER 2004

8 NOVEMBER 2004

6 DECEMBER 2004

10 JANUARY 2005

3 FEBRUARY 2005

8 MARCH 2005

25 APRIL 2005

19 MAY 2005

APPENDIX 3

**PHOTOGRAPHIC COMPARISON BETWEEN *ISEED* TREATED SEED &
UN-TREATED SEED SOWN AT STANDARD RATE (25 G M-2) TAKEN ON
THE FOLLOWING DATES**

2 JUNE 2004

8 JUNE 2004

22 JUNE 2004

14 JULY 2004

11 AUGUST 2004

23 SEPTEMBER 2004

8 NOVEMBER 2004

6 DECEMBER 2004

10 JANUARY 2005

3 FEBRUARY 2005

8 MARCH 2005

25 APRIL 2005

19 MAY 2005