The Use of Black Sand to Accelerate Creeping Bentgrass Seed Germination and Emergence on a Late Fall Planted Putting Green

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A field study was conducted on the 17th green at the Palouse Ridge Golf Club at WSU, in Pullman, WA, during the late fall of 2007 to determine the effectiveness of black sand, applied as topdressing, to accelerate creeping bentgrass seed germination and seedling emergence. Palouse Ridge Golf Club is currently under construction and grow-in. The green was constructed to California green specifications using 100% Atlas greens grade sand (Atlas Sand and Rock. Lewiston, ID). No organic matter was added to the greens sand. Creeping bentgrass (cv. 'T-1') seed was planted at 2.0 lbs/M on 28 Sept 07. On 5 Oct 07, Black sandand Atlas sand topdressing treatments were applied at 200 and 400 lbs/M using a Gandy drop spreader (Figure 1). An additional treatment was the use of a protective cover (Reemay 1.5 oz/yd^2). The Reemay cover was fastened in place using metal sod staples (Figure 2). The experiment was set up as a randomized-complete block design with 4 replications and individual plots were 10' x 10'. Beginning at 10 days after treatment (DAT) and up to 35 DAT, visual seedling emergence was rated using a scale of 0-10, with 0 = no emergence. At 35 DAT (9 Nov 07) a grid with 1" squares (Figure 3) was placed randomly at 3 different areas within each plot and a digital picture was taken. Seedlings were counted, in a 25 in^2 area, from each picture. Soil temperature within a 200 and 400 lbs/M black sand, Reemay cover and Atlas sand plot, at depth of 0.5", was recorded every hour beginning on 19 Oct 07 though 35 DAT, using a Hobo datalogger. Soil temperatures are being recorded throughout the winter.

By 10 DAT, the 400 lbs/M black sand and the Reemay cover treatments showed the highest number of seedlings of all the treatments (Table 1 and Figures 4 and 5). This was followed by black sand at 200 lbs/M then by the Atlas sand treatments and the check. This same trend, for the most part, continued up to 28 DAT. However, by 35 DAT, both visual and actual seedling counts were highest for the 400 lbs/M black sand treatment compared to all the other treatments (Table 1 and Figure 5). The seedling counts for black sand at 400 lbs/M were 2.5 times greater than the check. There were no significant differences in actual seedling counts between Reemay cover, black sand at 200 lbs/M, or Atlas sand at 400 lbs/M treatments. Of the topdressing treatments, Atlas sand at 200 lbs/M had the lowest seedling counts 35 DAT. During the study, the black sand on 2 of the plots (replications) with the 200 lbs/M treatment was blown off, thus exposing the lighter Atlas sand of the

original green (Figure 6). This affected visual seedling emergence ratings beginning at 21 DAT (26 Oct 07). Ratings in the 2 replications in which the black sand blew off averaged 3.5 while the plots in which the black sand remained intact averaged 6.0. In addition, the 2 replications in which the black sand remained had an average seedling count of 707 per ft^2 while the 2 replications in which the black sand was blown off had an average seedling count of 417 per ft^2 (raw data not presented), the same as the check. When analyzing these data for seedling counts, the 2 replications of black sand at 200 lbs/M, in which the black sand was blown off, were not included.

Soil temperatures from a 2 week period, 22 Oct to 4 Nov 07, were used to illustrate the average temperatures each hour during this time period (Figure 7). All treatments reached their highest average temperature at 13:55. Both black sand treatments had the highest temperature at a little over 56 °F, followed by the Atlas sand at 55 °F, and the Reemay cover at 53 °F. It was surprising to see that the soil temperature under the Reemay cover was lower than any of the sand topdressing treatments during the middle of the day, since one might expect that the Reemay would trap more heat under the cover than the exposed sand. It appears that the white color of the Reemay is preventing some of the radiation from reaching the ground. However, during the night the Reemay cover did hold in more heat compared to the sand treatments as one would expect. Figure 8 illustrates the difference between black sand at 400 lbs/M and each of the other treatments. During the middle of the day the black sand at 400 lbs/M was over 3 °F warmer than the Reemay cover, but at night the temperature of the soil under the Reemay cover was 1.5 °F warmer than the 400 lbs/M black sand treatment. It was very surprising to see that the black sand at 400 lbs/M treatment maintained a temperature about 1 °F higher than the black sand at 200 lbs/M or the Atlas sand from 17:55 in the evening to 7:55 in the morning. One would expect that the temperatures of the exposed sand treatments would be virtually the same at night. During the middle of the day the black sand at 400 lbs/M maintained a soil temperature of at least 1 °F higher than that of the Atlas sand. These higher differences in soil temperature between the black sand at 400 lbs/M and the other treatments, may in part, explain why more seed germinated and emerged at this high black sand rate.

Figure 1. Application of black sand at 400 lbs/M on 5 Oct 07.

Figure 2. Fastening the Reemay cover with sod staples on 5 Oct 07.

Figure 3. Digital photograph showing the grid with 1" squares used to make the seedling emergence counts.

Table 1. The effect of black sand, Atlas sand, and a Reemay cover on seedling emergence of a late fall planted 'T-1' creeping bentgrass green.

Treatment	Sand (lbs/M)	Visual seedling emergence* 10/15/07 10 DAT	10/19/07 14 DAT	10/26/07 21 DAT	11/2/07 28 DAT	11/9/07 35 DAT	11/9/07 Seedling count (number/ft^2)
Black sand 200 lbs/M	200	3.0 b**	4.0 c	4.3 b	4.5 b	4.8 c	706.8 bc
Black sand 400 lbs/M	400	3.8 a	5.8 a	6.8 a	7.0 a	7.5 a	1026.7 a
Atlas sand 200 lbs/M	200	1.3 cd	2.3 d	3.5 bc	3.5 b	3.5 d	540.0 cd
Atlas sand 400 lbs/M	400	1.8 c	2.8 d	3.8 bc	4.0 b	4.0 cd	657.1 bc
Reemay cover (1.5 oz/yd^2)	0	4.0 a	4.8 b	6.3 a	6.0 a	6.3 b	769.9 b
CHECK	0	1.0 d	2.8 d	3.3 c	4.0 b	3.5 d	421.9 d

*Visual seedling emergence rated 0-10, with 0 = no emergence.

**Values within a column followed by the same letter are not significantly different LSD *P* = 0.05.

Figure 4. The effect of black sand, Atlas sand, and a Reemay cover on visual seedling emergence of 'T-1' creeping bentgrass planted late in the fall.

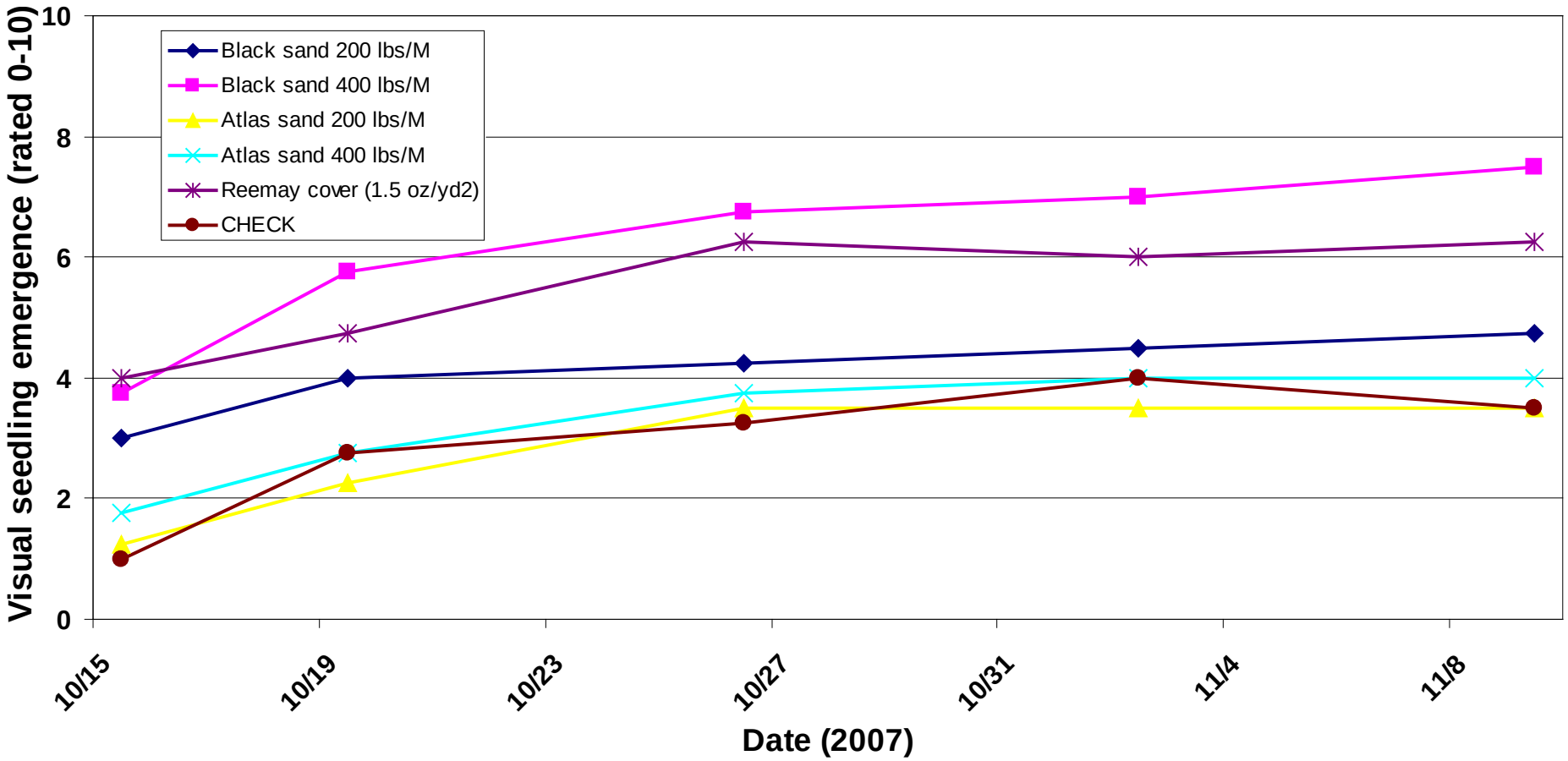

Figure 5. The effect of black sand, Atlas sand, and a Reemay cover on seedling count of a late fall planted 'T-1' creeping bentgrass green.

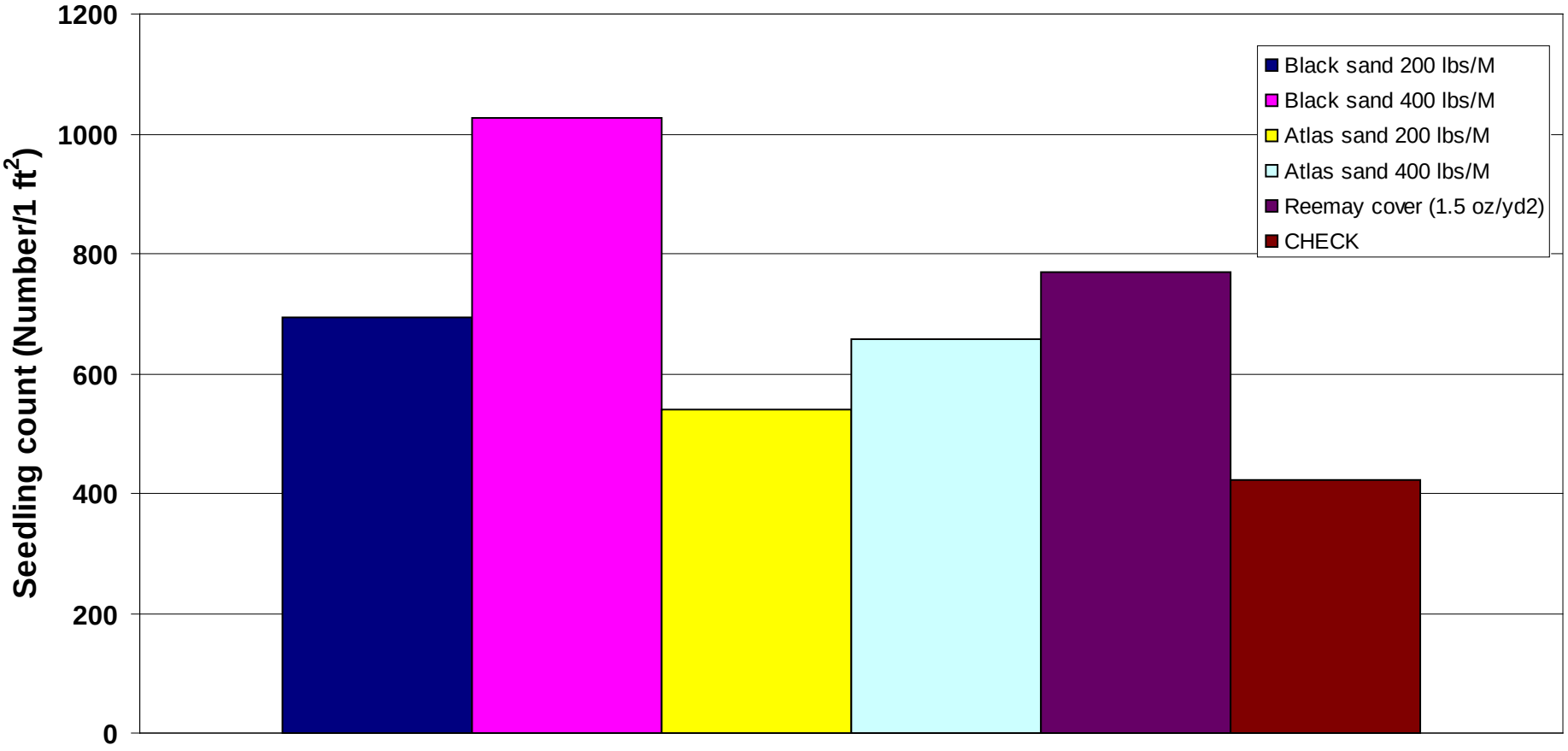

Figure 6. The 2 black sand at 200 lbs/M plots (replications) in which the black sand was blown away.

Figure 7. Soil temperature, averaged over each hour from 22 Oct to 4 Nov 2007.

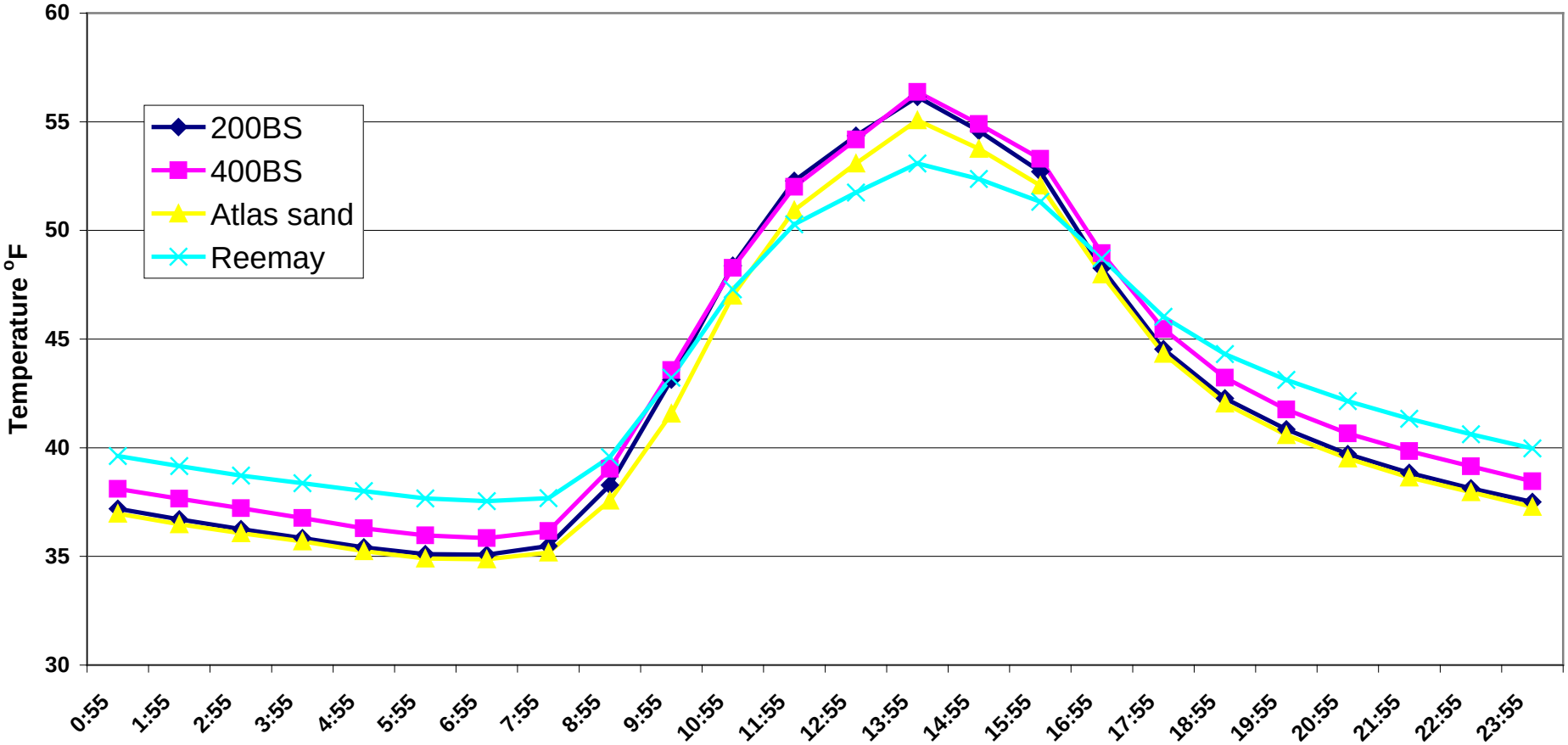

Figure 8. The difference in soil temperature, at a depth of 0.5", between black sand at 400 lbs/M compared to Black sandat 200 lbs/M, Atlas sand, and Reemay cover from 22 Oct to 4 Nov 2007.