# Effects of "Immerse GT" and "Immerse GT 2009" Wetting Agents on Localized Dry Spot Incidence and Rootzone Moisture Distribution

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**Additional index words:** putting green, creeping bentgrass, time domain reflectometry

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Wetting agent application to experimental putting green plots.

**Summary.** As new wetting agents reach the market for putting green management, it is important to understand not only how they affect the incidence of localized dry spot (LDS), but also how they affect moisture retention and distribution throughout the putting green rootzone. The objective of this research was to determine how localized dry spot incidence, and soil moisture content and uniformity were affected by the application of "Immerse GT" and "Immerse GT 2009", two newer wetting agent products from Amega Sciences. Wetting agents were applied during the 2009 growing season and evaluated under conditions of moderate and infrequent irrigation application. Both wetting agents tested in this study significantly reduced LDS formation compared to the untreated control. In addition, neither wetting agent significantly increased soil moisture values under wet conditions, whereas both wetting agents significantly increased soil moisture content and uniformity, compared to the untreated turf, during periods of drought stress. It appears that these relatively new wetting agents can be used to effectively manage LDS and improve rootzone moisture distribution.

**Abbreviations:** LDS, localized dry spot

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Previous research on wetting agent application to sand-based putting greens has demonstrated that many commercially available products are effective in reducing soil hydrophobic properties and/or visual localized dry spot (LDS) symptoms. As new wetting agent products become available for use in the turf industry, it is important to understand not only how effective they are at reducing LDS symptoms, but also how they affect rootzone moisture following application. The objective of this research was to determine how two newer wetting agent products, "Immerse GT" and "Immerse GT 2009", control LDS and affect rootzone moisture distribution when applied to a sand-based putting green under varying moisture conditions.

**Materials and Methods**

This experiment was conducted from July through October in 2009 at the University of Arkansas Research and Extension Center in Fayetteville on a creeping bentgrass (*Agrostis stolonifera* cv. L-93) putting green built according to United States Golf Association specifications. The green was mowed at a 0.125 inch height six days per week and otherwise maintained under typical golf course conditions (Table 1).

Treatments consisted of two wetting agent products, Immerse GT and an experimental product, Immerse GT 2009 (Amega Sciences, USA, Saint Cloud, Fla.), and untreated control. Both wetting agents were applied at 6 fluid ounces per 1000 $ft^2$ and irrigated with 0.25 inch of water following application. Treatments were initially applied on 8 July and 14 days later on 22 July. Thereafter, treatments were applied monthly on 18 August and 16 September. Each treatment was applied to four replicate plots, measuring 6 by 6 ft each. Irrigation was applied moderately (every 2-3 d), in June and sparingly (only under severe drought stress) thereafter to compare the wetting agents under a range of moisture conditions. In addition, the experimental area was irrigated heavily the morning of 17 July to evaluate the wetting agents under wet conditions.

Treatments were evaluated for LDS incidence and soil moisture characteristics. Localized dry spot incidence was rated weekly as a visual estimate of the percentage within each plot affected with LDS. Volumetric soil moisture was evaluated twice monthly by taking 36 measurements on a 1 by 1 ft. grid at three sampling depths (3, 5, and 8 inch) within each plot using time domain reflectometry moisture probes (TDR 300, Spectrum Technologies, Plainfield, Ill., USA). From the moisture data, average rootzone moisture content and soil moisture variability (measured by standard deviation; n = 36) were calculated for each wetting agent at each sampling depth.

**Results and Discussion**

*LDS incidence*. Although no wetting agent had been applied to the experimental area prior to 8 July, there was a relatively low incidence of LDS across the plots at the beginning of the trial because the experimental area had been irrigated judiciously the previous month. There were no statistically significant differences in LDS incidence among treatments for the first five weeks of the trial (Fig. 1). However, from the 19 August evaluation date through the end of the trial, both wetting agent treatments resulted in significantly less LDS formation than the untreated control. From 26 August through the end of the study, untreated turf averaged over 40% LDS on all evaluation dates (except for 2 September), while turf treated with wetting agent averaged below 15% LDS during that same period (Figs. 1 and 2). There were no differences in LDS formation between Immerse GT and Immerse GT 2009.

*Visual quality*. Since LDS incidence had a strong influence on turf quality, treatment effects on visual quality were similar as for LDS incidence. However, there were significant differences among treatments by 6 August, less than one month following the initial wetting agent application (Fig. 3). From 6 August through the end of the trial, both wetting agent treatments resulted in significantly greater turf quality than the untreated control. Both wetting agent treatments resulted in turf quality that was above acceptable (>6.0) throughout the trial, with the exception of Immerse GT on 26 August. There were no significant differences in turf quality between Immerse GT and Immerse GT 2009.

*Soil moisture content*. Across the experimental area, soil moisture was highest (17.1%) on the first evaluation date, 17 July, nine days after the study began and a few hours after the experimental area received a heavy irrigation. After July, when the area was irrigated sparingly, average soil moisture values across the experimental area were never above 10% and fell to a low of 6.6% on 28 August during a period of extreme drought stress.

Wetting agent treatment had a significant effect on soil moisture content, especially towards the end of the study. Although measurement depth also affected soil moisture content (wetter near the surface), there was not a significant wetting agent treatment by depth interaction (i.e., wetting agent effects were consistent across all three measurement depths). Therefore, wetting agent treatment effects will be discussed as averaged across all three measurement depths. On 17 July, under relatively wet conditions due to a recent irrigation event, there were no differences among treatments in soil moisture content (Fig. 4), indicating that these wetting agents do not hold excessive moisture near the rootzone surface. On 31 July, and from 28 August through the end of the trial, when the experimental area was under drought stress, both wetting agent treatments resulted in higher soil moisture values than the untreated control. There were no significant differences in soil moisture content between Immerse GT and Immerse GT 2009.

*Soil moisture variation*. Across the experimental area, soil moisture variation was greatest early in the trial, on 31 July, as plots were drying out and the irrigation regime was transitioning from moderate to sparing. Prior to this date, plots were more uniformly moist, while after this date, the untreated control plots increased in moisture uniformity (from isolated dry areas to uniformly dry), and plots treated with wetting agent maintained relatively uniform soil moisture conditions.

Wetting agent treatment had a significant effect on soil moisture variability throughout the study and although measurement depth also affected soil moisture variability (more variability near the surface), there was not a significant wetting agent treatment by depth interaction (i.e., wetting agent effects were consistent across all three measurement depths). Therefore, wetting agent treatments effects will be discussed as averaged across all three measurement depths. Throughout the study, both wetting agents significantly decreased soil moisture variability compared to the untreated control, except for Immerse GT 2009 on 14 August (Fig. 5). The reduction in soil moisture variability resulting from wetting agent treatment peaked in late September, following a prolonged period of drought stress across the experimental area (Fig. 5). Mapping soil moisture values from that time shows a significant increase in moisture retention and uniformity, at all three depths, as caused by wetting agent application (Fig. 6). There were no significant differences between the two wetting agents throughout the study. These results indicate that Immerse GT and Immerse GT 2009 increase soil moisture uniformity across a range of soil moisture contents (Fig. 4). This should translate to more efficient irrigation management, allowing for longer periods between irrigation events and reduced hand-watering since isolated areas of drier rootzone conditions are less likely when using these wetting agents.

## Conclusions

Immerse GT and Immerse GT 2009 were effective in reducing LDS symptoms and improving soil moisture uniformity during wet and dry periods. These wetting agents do not appear to retain excessive moisture near the rootzone surface under wet conditions and they were effective in retaining more moisture during drought periods than untreated turf. These wetting agents show promise for managing LDS and soil moisture in sand-based putting greens.

**Table 1. Maintenance of the experimental area.**

| Maintenance Practice | Description |
|---|---|
| Mowing | Six times per week at a 0.125 inch mowing height. |
| Fertility | 0.5, 0.1, and 0.5 lb of N, $K_2O$, and $P_2O_5$, respectively, per 1000 $ft^2$ per month of active growth. Other nutrients applied according to soil test recommendations. |
| Irrigation | Moderate (July) – as needed to prevent moderate drought stress symptoms. Infrequent (August - October) – only to prevent extreme drought stress symptoms. |
| Growth regulation | Primo Maxx (trinexapac-ethyl) applied at 1/8 oz. per 1000 $ft^2$ per month of active growth. |
| Cultivation | Hollow tine cultivation performed to affect 5% of the surface in the spring and fall. |
| Sand topdressing | Sand topdressing applied every 14 days throughout the growing season at an approximate rate of 4 $ft^3$ sand per 1000 $ft^2$. |
| Pesticides | Applied only on a curative basis. |

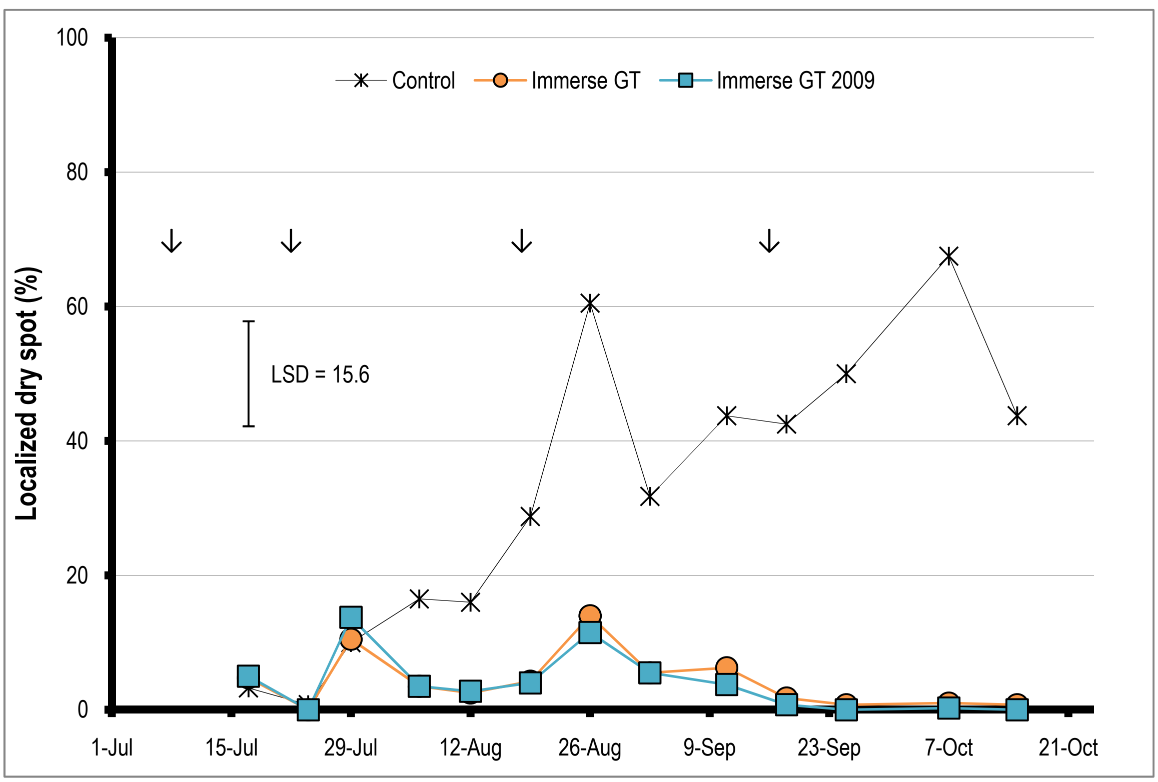


**Fig. 1. Localized dry spot incidence as affected by wetting agent treatment. Arrows indicate wetting agent application dates. Error bar represents Fisher's least significant difference value ($\alpha$ = 0.05) for comparing wetting agent treatments within dates.**

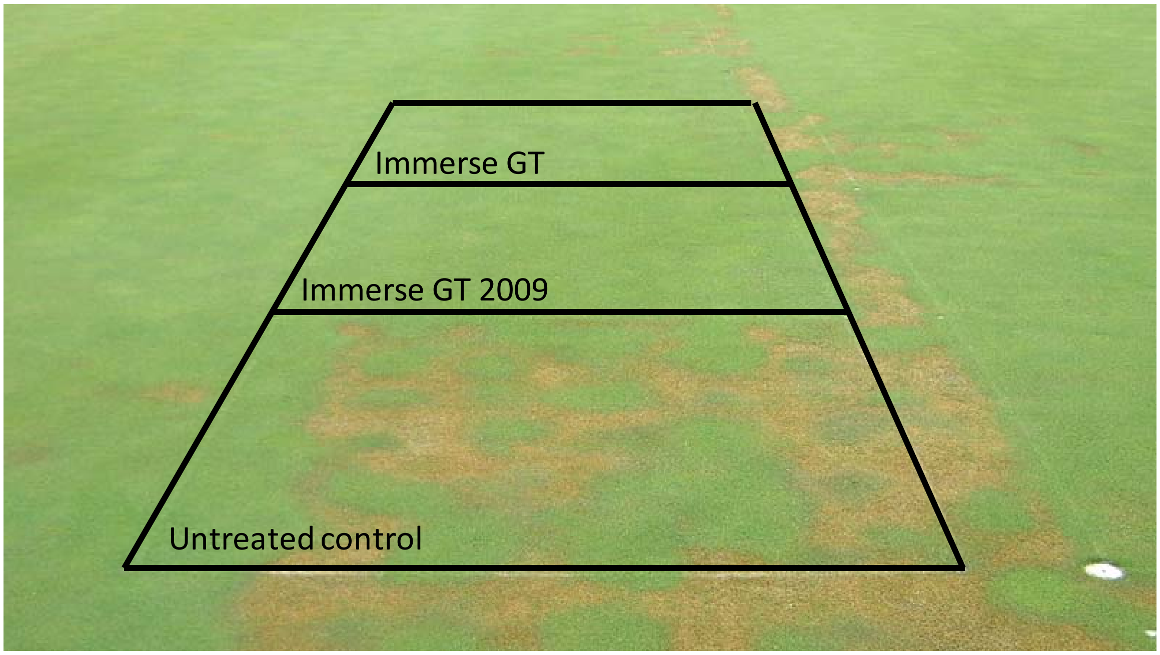


**Fig. 2. A replicate of plots showing a reduction in LDS symptoms from wetting agent treatments. Note the LDS in the untreated border around the plots. Photo taken 18 August 2009.**

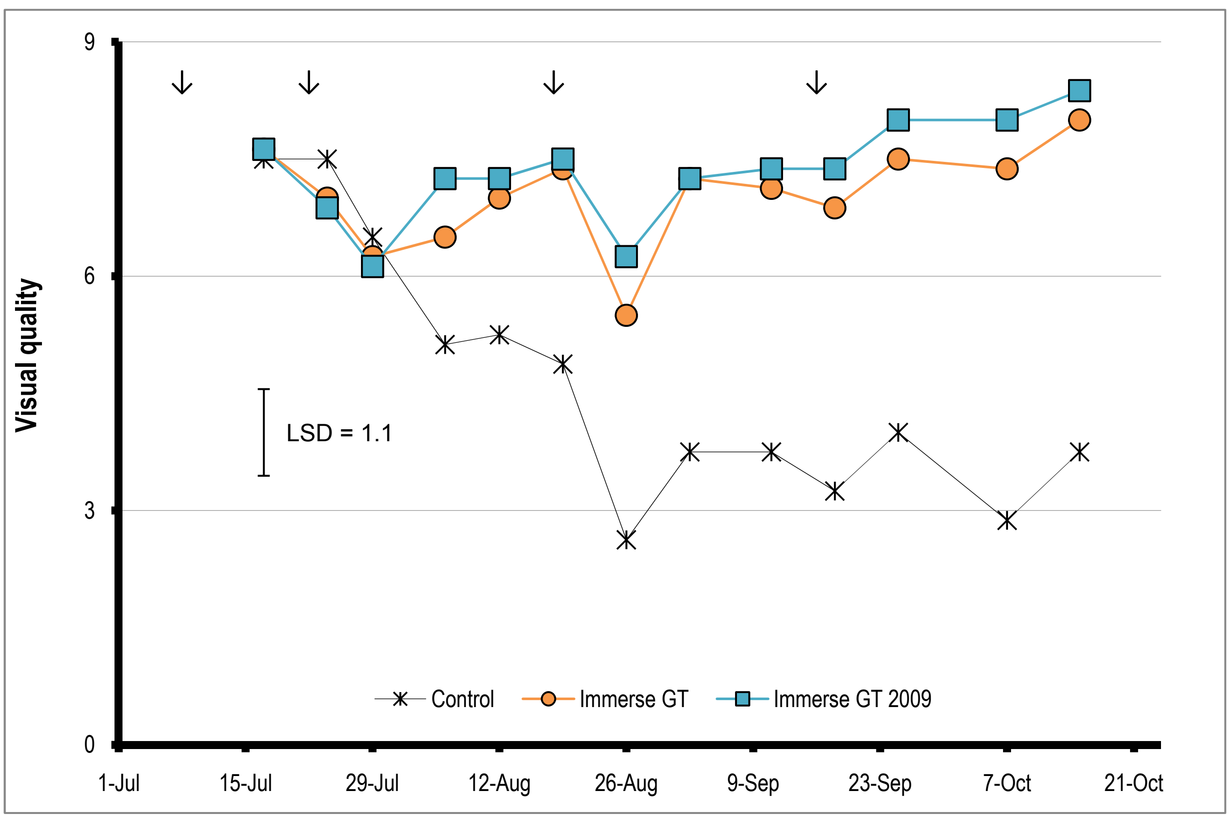


**Fig. 3. Visual turf quality (9 = ideal, 6 = acceptable, 1 = dead) as affected by wetting agent treatment. Arrows indicate wetting agent application dates. Error bar represents Fisher's least significant difference value ($\alpha$ = 0.05) for comparing wetting agent treatments within dates.**

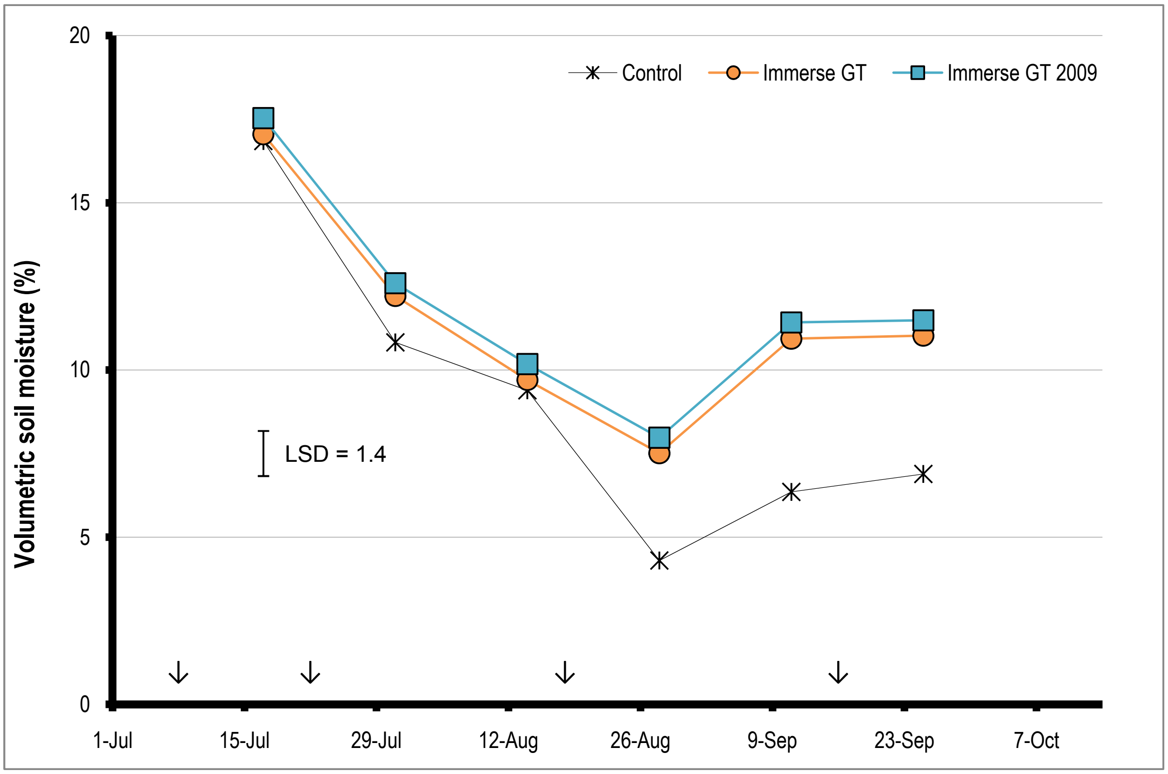


**Fig. 4. Volumetric soil moisture (%) as affected by wetting agent treatment. Arrows indicate wetting agent application dates. Error bar represents Fisher's least significant difference value ($\alpha$ = 0.05) for comparing wetting agent treatments within dates.**

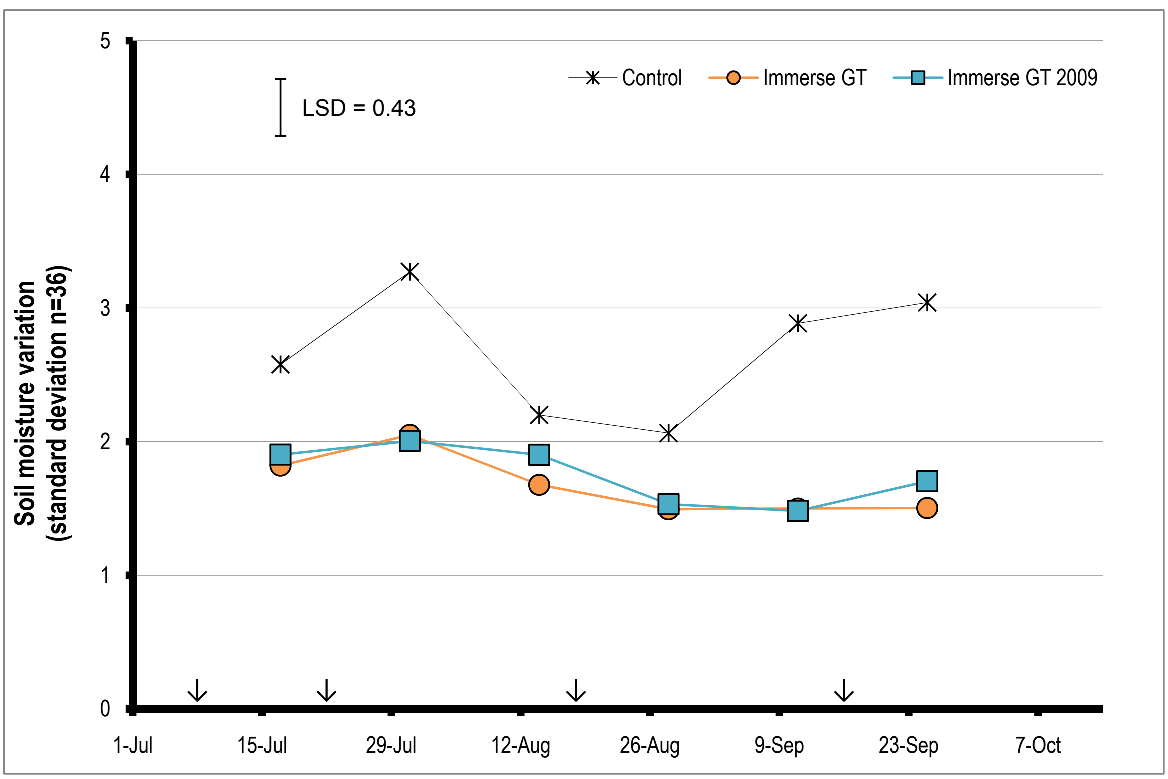


**Fig. 5. Soil moisture variation as affected by wetting agent treatment. Arrows indicate wetting agent application dates. Error bar represents Fisher's least significant difference value ($\alpha$ = 0.05) for comparing wetting agent treatments within dates.**

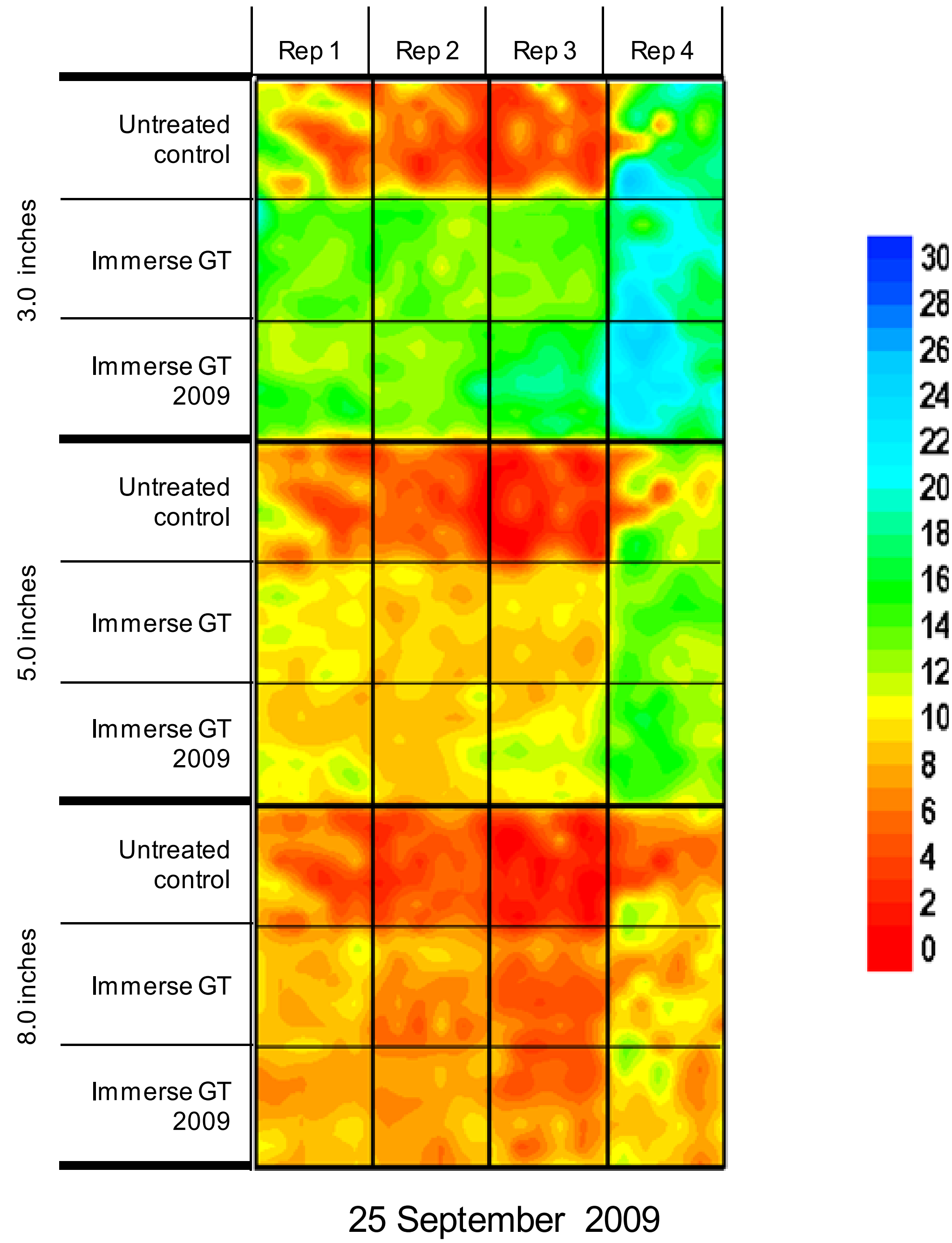


**Fig. 6. Soil moisture maps of all plots at all three measurement depths from 25 September 2009.**