Thatch management through various cultural practices on a mixed stand putting green

Principal investigators:
Katerina S. Jordan
Eric Lyons

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Introduction:

Thatch is the layer of partially decomposed organic matter in between the turf's surface and soil layer. In general, a small amount of thatch is considered to be beneficial for the turfgrass, offering protection for the crown of the plant. However, an excess layer of thatch can lead to a multitude of problems, including reduced infiltration, reduced water retention, shallow rooting, and formation of localized dry spots. That is particularly harmful on golf course putting greens as these areas are highly managed and kept at mowing heights that are often stressful for the turfgrass plants. As such, the presence of thatch both adversely affects the overall health of the turf as well as the quality of the playing surface – especially when levels are excessive (> 2.54 cm). Unfortunately, removal of this layer often requires methods that are disruptive to play, including core aeration followed by topdressing and vertical mowing. Therefore a thorough understanding of the most effective methods as well as frequencies of these methods needs to be studied to ensure that any disruption in play will lead to desired results with respect to thatch removal. Recent research conducted in South Carolina looked at a variety of methods aimed at prevention (McCarty et al., 2005) and then reduction (McCarty et al., 2007) of thatch on creeping bentgrass (*Agrostis stolonifera* L.) putting greens. Results indicated that only a combination of grooming, core cultivation and vertical mowing significantly reduced thatch layers and increased water infiltration. However, both studies were run for only two years, and it is possible that greater effects would have been seen if treatments had continued over a longer period of time.

The purpose of this study has been to determine the effects of a variety of cultural methods aimed at thatch reduction on thatch levels and turf health in general.

Funding for this project was provided by OTRF in 2006 and 2007 and was matched by the Quebec Turfgrass Research Foundation in 2008. This report is meant as a final report for the OTRF, however, as the study will continue for at least one more year, an updated report will be submitted in the 2011 season.

Methods:

The experiment has been run for two full years to date with treatments initiated in fall of 2007. Treatments included solid tine aeration, hollow tine aeration, vertical mowing at varying depths and combination of the above (Table 1). In addition, plots were split in half and one half received weekly topdressing while the other did not.

Table 1. List of treatments administered from Fall 2007 through Fall 2009

Treatment	Treatment code
¼" Solid tine aeration, spring and fall	ST ¼" S+F
¼" Hollow tine aeration, spring and fall	HT ¼" S+F
5/8" Hollow tine aeration, spring and fall	HT 5/8" S+F
Vertical mowing, 2cm depth, Spring + 5/8" Hollow tine aeration, Fall	VC 2cm S + HT 5/8" F
Vertical mowing, 2cm depth, Spring and Fall	VC 2cm S+F
Vertical mowing, 1 cm depth, Spring and Fall	VC 1cm S+F
Vertical mowing, 0.5 cm depth, Bi-weekly	VC 0.5 cm Bi-W
Vertical mowing, 0.5 cm depth, Bi-weekly + ¼" Solid tine aeration Spring and Fall	VC 0.5cm Bi-W + ST ¼" S+F
Vertical mowing, 0.5cm depth, Bi-weekly + ¼" Hollow tine aeration Spring and Fall	VC 0.5cm Bi-W + HT ¼" S+F
Control (No treatment)	Control

Plots were 1.3 m wide by 2m in length. Topdressing applied on a weekly basis consisted of an 80:20 sand:peat mixture and was applied at the rate of 1.3 L per plot to achieve a depth of 0.5 mm sand. Topdressing was also applied following cultivation treatments and was applied to fill holes and therefore varied based on the specific treatment: 5/8" HT received 13L; ¼" HT received 5L; ¼" ST received no topdressing; 2 cm VC received 10 L; 1 cm VC received 5L. Additional sand was not added following bi-weekly grooming with vertical mower.

Measurements taken included: thatch measurements (mm), percent organic matter in 2-inch cores, water infiltration rate, surface firmness reading (using Clegg hammer impact device), ball roll distance over the plot area and turfgrass quality..

Results and Discussion:

Thatch measurements showed that thatch layers increased from 2008 to 2009 in all treatments of the study (Fig. 1). Average thatch levels were approximately 20 mm prior to initiation of the study and by fall of 2009, levels were as high as 34 mm in the 5/8" hollow tine treatment and only 26 mm in the control. However, thatch layers were very distinct prior to treatment applications and continued to show a

distinct thatch layer in the control through the 2009 season. For the cultivation treatments, the thatch layer became more inter-mingled with the soil and was more of mat layer. This was confirmed by the percent organic matter data, which showed no significant increase in organic matter between the two seasons (Fig. 2). This suggests that the organic matter in the plots subjected to cultivation treatments was diluted over a larger area than in the control plot.

Similar results were observed as a result of the weekly topdressing (Figs. 3 and 4). Thatch levels were greater in the topdressed plots than in the non-topdressed, however, percent organic matter levels were unchanged between the two treatments. In addition, data showed that organic matter levels were significantly higher in the top 2.5 cm of the non-topdressed plots than in the bottom 2.5 cm, while the opposite was the case in the topdressed plots (Fig. 5). This suggests that the organic matter is well diluted throughout the rootzone in the plots that received bi-weekly topdressing and concentrated in the top 2.5 cm of the rootzone in the non-topdressed areas.

There was a significant difference in firmness between the cultivation treatments but not between the topdressing treatments (data not shown). Firmness was greatest with the deep vertical mowing treatments that were conducted two times over the year. However, data on ball roll distance showed that there was no significant effect of cultivation on ball roll distance (Fig. 6). This discrepancy could be due to the soil beneath the excess thatch layers becoming more compacted than in the cultivated plots and that compaction throwing off the impact readings. This theory is supported by the water infiltration data for the 2009 season (Fig. 7).

At the end of each season, quality ratings were taken and for both 2008 and 2009 there were no significant differences between the treatments (data not shown).

Conclusions:

The data obtained in this study show that cultivation, whether through aeration or vertical mowing, and bi-weekly topdressing did not significantly reduce organic matter in the top 5 cm of a putting green rootzone. However, the concentration of organic matter was significantly reduced through both cultivation and topdressing as evidenced by the percent organic matter compared with the thatch levels. Although playing conditions were not significantly improved by the treatments, growing conditions were improved through aeration especially, as was seen with the infiltration data.

The results of this study suggest that further research is necessary to determine if the diluted organic matter will eventually be broken down and become indistinguishable from the soil. The researchers in this study plan to continue the study through the 2010 season and possibly for an additional year, depending on the results obtained.

Figures:

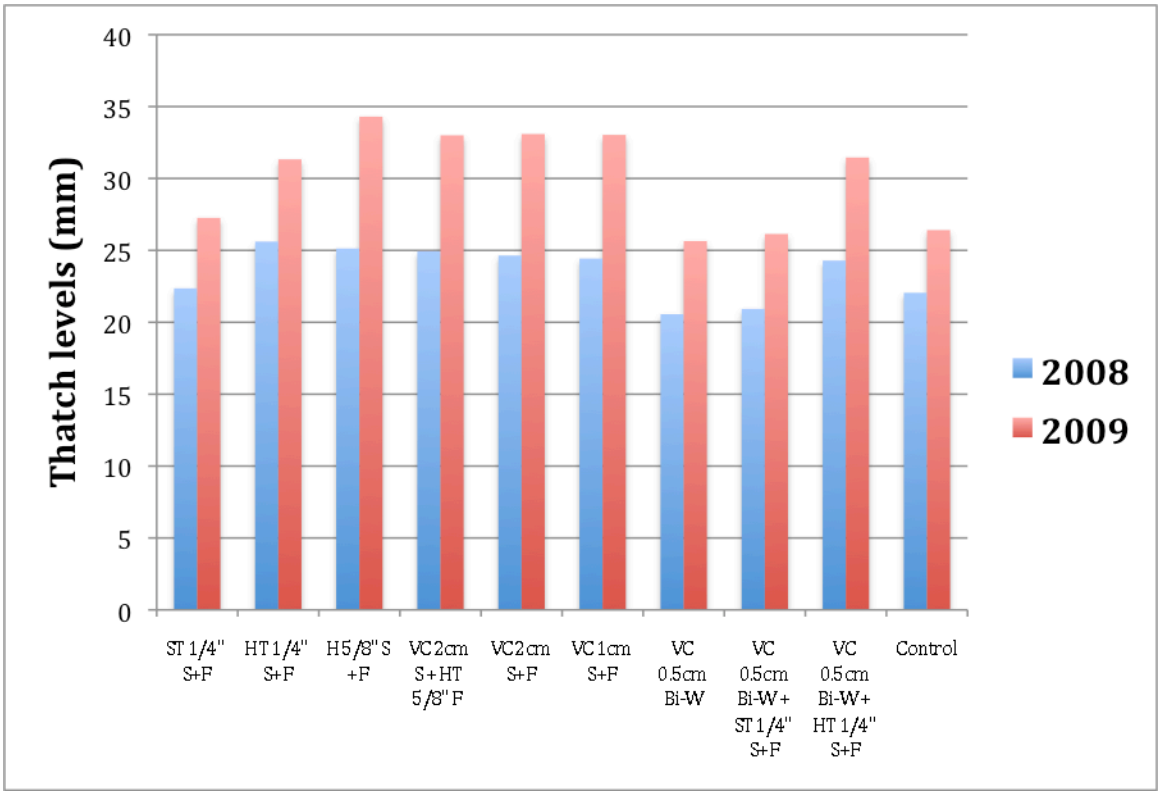

Fig. 1. Effect of cultivation treatments on thatch measurements in 2008 and 2009. Treatment codes are as follows: ST = solid tine aeration; HT = hollow tine aeration; ¼" = ¼" tine diameter; 5/8" = 5/8" tine diameter; S = spring; F = fall; VC = vertical mowing; 2 cm = 2cm verticutting depth; 1cm = 1cm verticutting depth, 0.5 cm = 0.5 cm verticutting depth, Bi-W = bi-weekly.

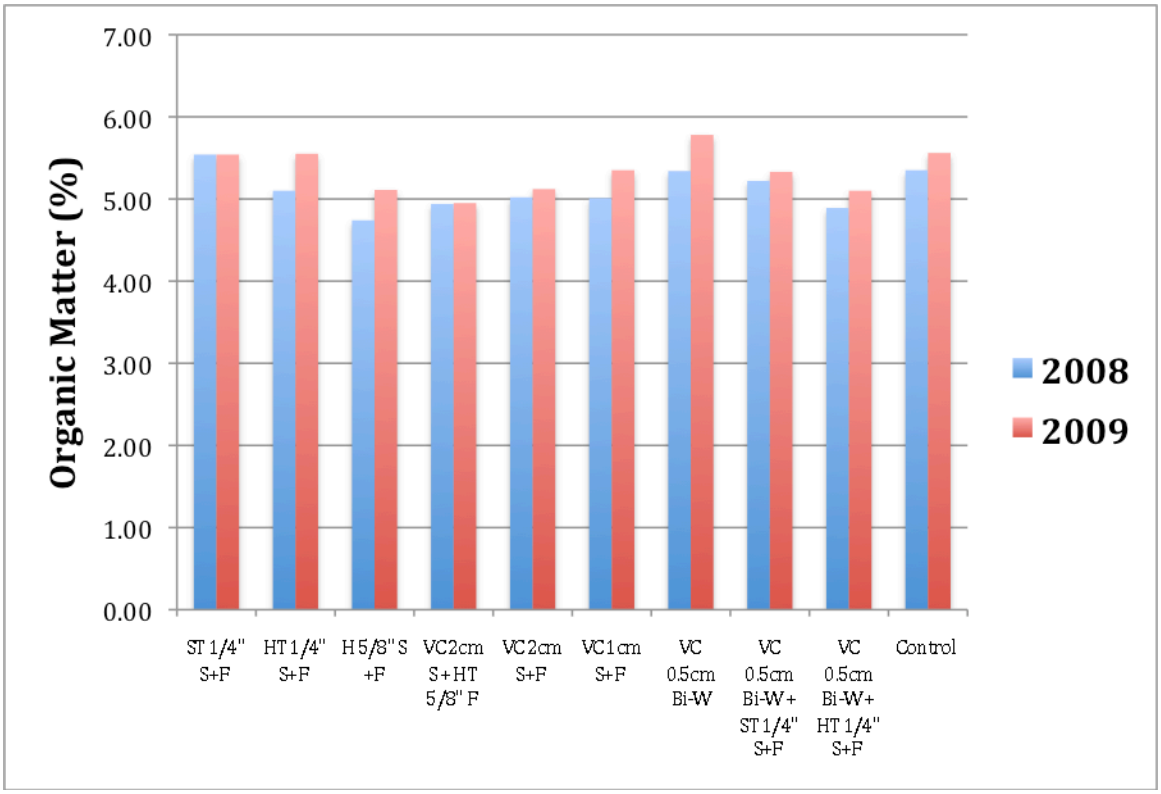

Fig. 2. Effect of cultivation treatments on percent organic matter in 2008 and 2009. Treatment codes are as follows: ST = solid tine aeration; HT = hollow tine aeration; ¼" = ¼" tine diameter; 5/8" = 5/8" tine diameter; S = spring; F = fall; VC = vertical mowing; 2 cm = 2cm verticutting depth; 1cm = 1cm verticutting depth, 0.5 cm = 0.5 cm verticutting depth, Bi-W = bi-weekly.

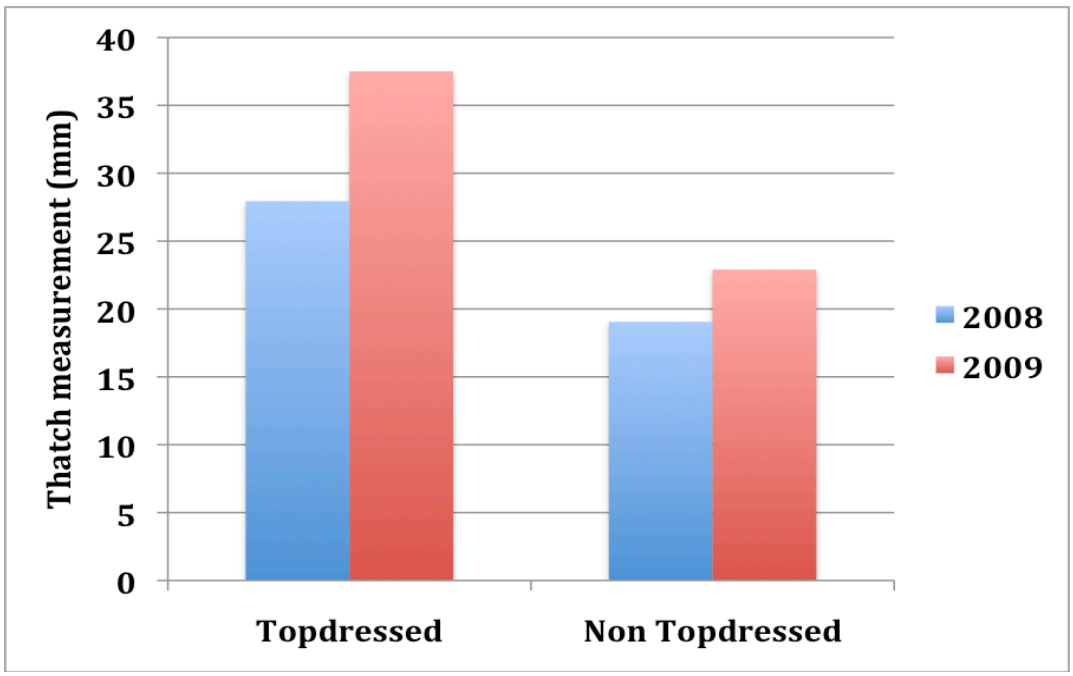

Fig. 3. Effect of bi-weekly topdressing on thatch levels in 2008 and 2009.

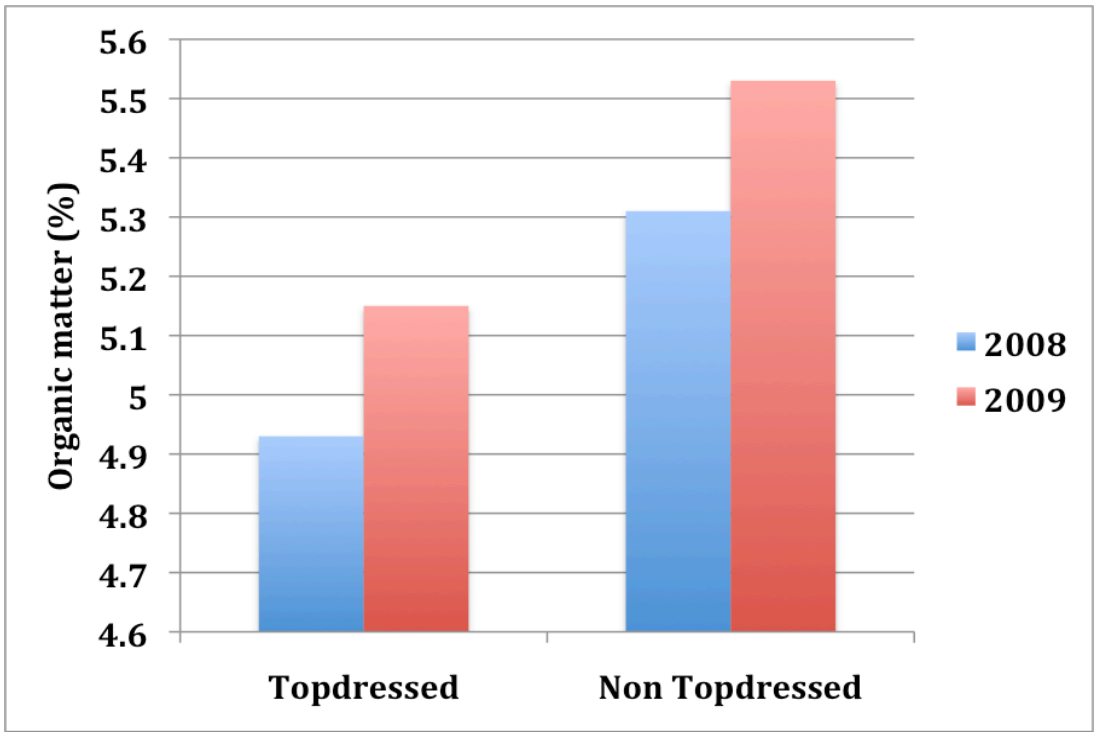

Fig. 4. Effect of bi-weekly topdressing on percent organic matter in 2008 and 2009.

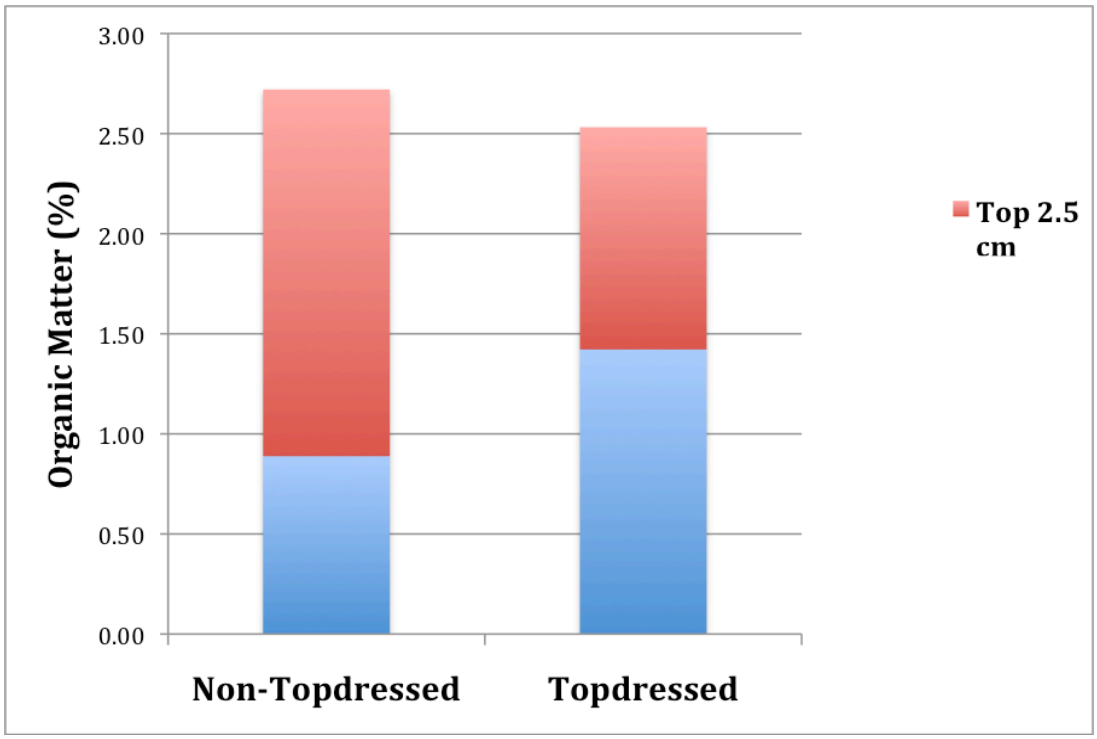

Fig. 5. Effect of topdressing on percent organic matter, separated by top 2.5 cm and bottom 2.5 cm of rootzone. Values are additive, not separate, on the chart.

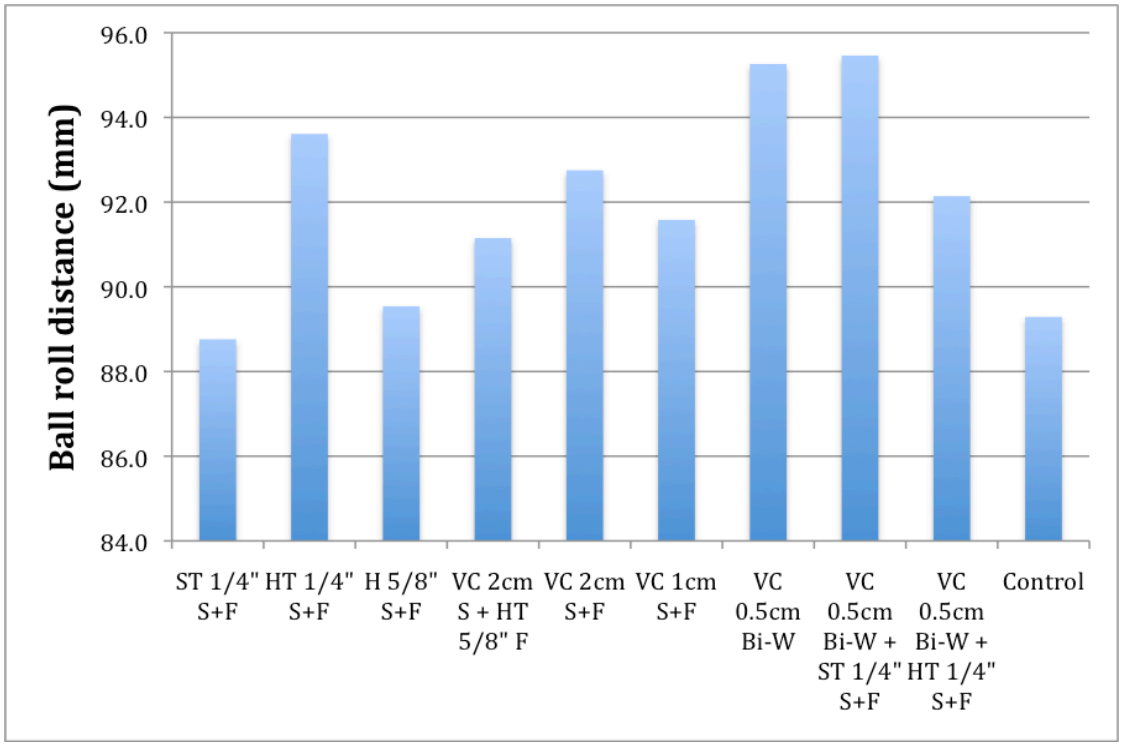

Fig. 6. Effect of cultivation on ball roll distance within test plots.

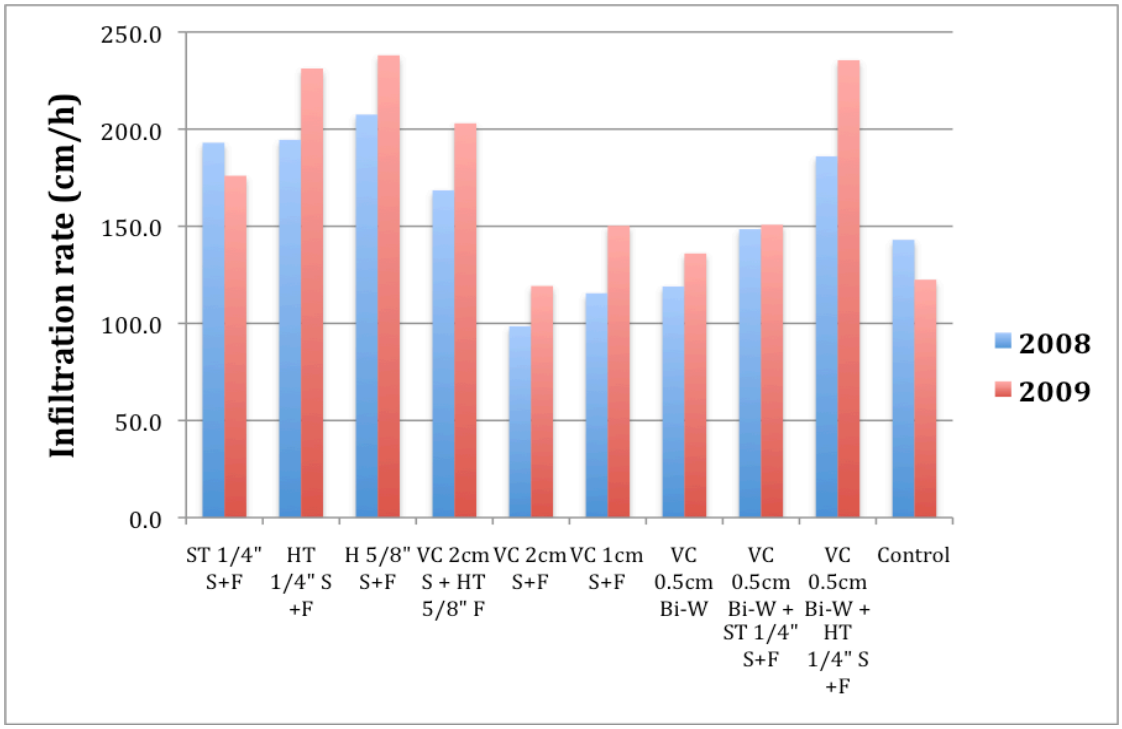

Fig. 7. Effect of cultivation treatments on water infiltration rate. Treatment codes are as follows: ST = solid tine aeration; HT = hollow tine aeration; ¼" = ¼" tine diameter; 5/8" = 5/8" tine diameter; S = spring; F = fall; VC = vertical mowing; 2 cm = 2cm verticutting depth; 1cm = 1cm verticutting depth, 0.5 cm = 0.5 cm verticutting depth, Bi-W = bi-weekly.