Assessing Soil Organic Matter Dynamics and Carbon Sequestration in NZ Golf Course

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Golf courses are not only a leading sector of the sports turf industry, but also help the environment as a sink for CO_2 Turf grass helps decrease atmospheric CO_2 through photosynthesis, and some of the carbon may be sequestered in the soil. As part of a major research project examining the sustainable management of soil organic matter in golf greens, we compared the soil organic matter (SOM) status of golf greens of different ages that are maintained under the same root zone composition and management in Palmerston North, New Zealand. From the changes in SOM we were able to determine the rate and capacity of C sequestration with time. Triplicate soil samples from five depths (0-5, 5-10, 10-15, 15-20, and 20-25 cm) of 5, 9, 20, 30 and 40 year old greens were analyzed for SOM content with Loss-on-Ignition at 550 for 4.5 hours and total C using LECO FP 2000 automated analyzer. In addition, the soil microbial activity, bulk density, water content, pH, EC, total N and C/N ratio were measured. Linear regression analysis of data indicated the pattern of SOM accumulation was strongly affected by age in spite of the intensive cultivation during the course of turf management. In 0-25 cm deep sections, the SOM increased significantly with age and the rate of C sequestration was 720 kg C ha^{-1} yr^{-1}. SOM did not vary significantly in the 0-5 cm depth among five aged greens, and the average SOM ranged from 25887 to 28282 kg ha^{-1}. The rate of SOM in other depths ranged from 470 to 538 kg ha^{-1} yr^{-1} during the first 40 years after turf grass establishment. There was a significant correlation between SOM and some of the properties that are likely to influence SOM accumulation such as pH, bulk density, and microbial activity. The pH decreased with year, which may influence SOM accumulation. A sharp drop in microbial activity was shown between 0-5cm and 5-10cm deep sections in all the greens: it wasn't affected by aeration, N-fertilizing, and water content; it was caused by decomposing-resistant SOM in 5-25cm deep sections. The soil of matured and aged greens can stably sequester organic matter in the long-term because of low pH, low microbial activity, and high bulk density.