Efficacy of Microbes in Soil Salinity Reduction

Principal Investigator: Larry Stowell

Cooperator: Don Parsons, Old Ranch Country Club

Sponsors: Old Ranch Country Club and PACE Consulting

Summary: A simple experiment was initiated to determine the effectiveness of three strains of bacteria claimed to be salt accumulating microorganisms. Some microorganisms are known to accumulate salts from the environment. These organisms might be used to reduce the salinity of soils provided the organisms are capable of accumulating and sequestering the salts effectively. The results described below indicate that the microorganisms evaluated in this study did not reduce soil salinity.

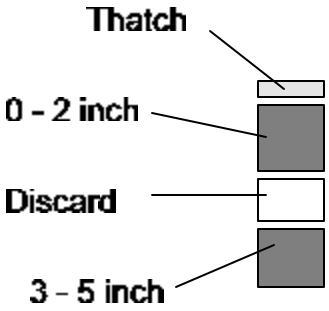
Materials and Methods: Three strains of salt neutralizing bacteria were obtained from International Ag Labs, P.O. Box 778, Fairmont, MN 56031. The strains were designated as #1, #25 and #50. No other specific information regarding the nature of the organisms is available. Each bacterial strain was applied to 1000 sq ft areas of a different green. the remaining portion of the green was left non-treated. Applications were made on the dates and at the rates listed in Table 1.

Table 1. Date of application and rate of bacterial suspension applied to the test areas.

Date	Rate (oz/1000 sq ft)
7/18/94	32
7/25/94	8
8/1/94	8
8/6/94	8

On 8/23/94, three samples, six inches deep, 2 inches in diameter, were collected from the treated and non-treated areas of each green using a soil probe with an acetate sample sleeve. Each sample was divided into three sections and electrical conductivity (EC) measurements were made on each section. Figure 1 illustrates how the sample was divided. In this report, the thatch sample is termed top, the 0-2 inch section 0, and the 3-5 inch section 3.

Figure. Illustration of sample core sections used for electrical conductivity evaluation.



The 0 and 3 inch sample sections were transferred into 150 cc beakers and soil moisture was brought to saturation using distilled water. In order to make EC evaluation simple and rapid, a series of parallel saturated soil paste extract EC (vacuum filtered through a Whatman #2 qualitative filter) measurements were made along with EC measurements using a Cole Parmer TDS-4 EC meter probed directly into the saturated soil paste. This meter has been used routinely to evaluate saturated soil EC values under laboratory and field Conditions (Stowell, L.J. and Davis, S. 1993. Direct measurement of electrical conductivity (EC) in golf course high-sand content soils. Phytopathology 83:693). The calibration equation listed in Figure 2 was used to convert TDS-4 meter readings into the equivalent saturated soil paste reading. The thatch sample EC was evaluated using a Cole Parmer TDS-4 EC meter only (see Photos 941718-6,7).

In order to determine if the presence of the bacteria might be influencing the readings, three samples of soil extract were filtered through a Gelman 0.45 um filter (product #4184) using pressure provided by a disposable sterile 50 cc syringe. This filter size will exclude bacteria from the soil extract.

Results and Discussion:

Calibration of the TDS-4 meter using parallel saturated paste extracts resulted in a highly significant correlation (see Fig 2.). All values for EC are reported as TDS-4 measurements converted into saturated paste equivalent values using the regression equation listed in Figure 1. Table 2 lists the mean EC values and results of analysis of variance. There was no significant difference between the treated and non-treated areas.

Figure 2. Correlation between TDS-4 direct saturated soil reading (TDS4) and saturated paste extract (dS/m). The regression equation is :

Saturated Paste Extract (dS/m) = 3.5 x TDS4 - 0.33
r = 0.94, p<0.001

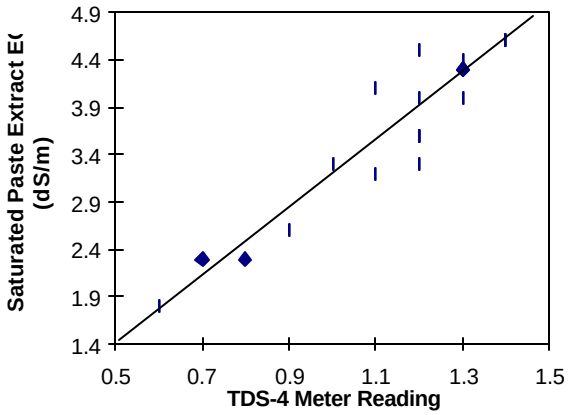


Table 2. Electrical conductivity of soil pastes (dS/m). Measurement using a TDS-4 EC meter converted to saturated paste extract equivalent. Numbers followed by the same letter are not significantly different (Fisher's LSD $p<0.05$).

Treatment	TOP	1 - 2 inch	2 - 5 inch
1	4.3a	2.7a	2.5a
1 non-treated	3.2a	4.1a	2.7a
25	3.3a	3.6a	2.1a
25 non-treated	2.8a	3.8a	1.9a
50	4.3a	3.9a	2.2a
50 non-treated	3.5a	3.5a	1.9a

The results of micro-filtration to remove the bacteria from the soil extract are listed in Table 3. There was no difference between the EC of soil extracts before and after filtration through a 0.45 um filter. This indicates that if there was bacteria in the solution prior to filtering, they did not influence the EC of the saturated paste extract. Combined with the data above, these results reveal that the microbes used as described in this report did not reduce soil salinity.

Table 3. Electrical conductivity of soil extract before and following micro-filtration through a 0.45 um filter used to remove bacteria.

Electrical Conductivity (dS/m)	
before filtration	after filtration (0.45 um)
4.4	4.4
4.6	4.5
2.6	2.6