Magnetically Treated Water (MTW)
Physical Properties and impact on Irrigated Crop Production

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Abstract

Field testing was conducted by applying treated and un-treated irrigation water to a sloping silt loam soil prone to surface sealing and surface runoff problems. Experiment design was randomized complete block with 6 replications. Surface runoff was collected from the base of each 22 x 35-foot plot. Field measurements include crop emergence, water volume applied, sprinkler throw distance and surface runoff. Slight increase in number of plants emerged and increases in sprinkler throw distance and water volume applied were measured in the MTW plots. Additional testing of MTW effect on surface runoff is needed to reduce variability and clarify actual differences.
Laboratory testing of soil physical properties of magnetically treated and non-treated water were also conducted to attempt to explain field responses. Significant changes were noted in viscosity, surface tension, density and pH. However, based on our current understanding of soil/water interactions and hydraulic processes the direction of these changes does not explain observed changes in infiltration, sprinkler throw distance, and increased flow through nozzles. Additional water properties may need to be considered, methodology may need to be improved or better instrumentation might be needed to better explain the relationship between property changes and observed field results

introduction

Significant numbers of anecdotal observations from golf courses and Salt Lake City parks indicate that MTW can reduce surface crusting and surface runoff from soils, which increases the fraction of applied water that moves into the soil to support plant growth, Additional observations indicate that throw distance and application uniformity increased with MTW and pressure losses in delivery piping and pump power required decreased with MTW. The purpose of this work is to verify these observations in randomized field testing under agricultural conditions. If these anecdotally observed benefits can be verified for agricultural conditions, agronomic and economic benefits to farmers would be significant.
It is reported in many papers and testimonials that magnetically treating water, affects its physical and agronomical properties. If proven to be true and beneficial it could provide a clean solution to boosting agronomical efficiencies where appropriate. This portion of our work involved testing some basic physical properties that could give us clues as to what's going on in regard to its agronomical properties. Papers report that MTW shows changes in viscosity, surface tension [1][3][2] and/or density [3]. Most papers also report an increase in pH [2][3]

Results

Figure 1. BROOKFIELD AMTEK DV-1 (viscometer used in measurement)

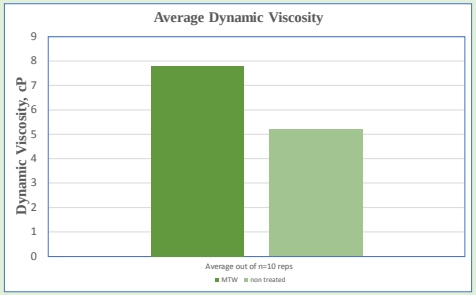

Figure 3. Average Dynamic Viscosity**,** 10 measurements for each treatment.

Viscosity increased on average by 2.6 cP after magnetic treatment

Figure 5. Capillary rise set up used to assess surface tension.

Figure 2. Field plots for runoff and stand count

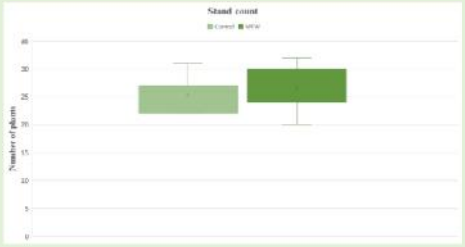

Figure 4. Plant stand counts

Stand count for MTW shows 4.7% more plants than the control

- Throw distance is 5.6% greater on MTW plots.
- Water volume applied is 8.5% higher for MTW plots.
- Specific gravity is greater for MTW by .45% a small percentage increase but appeared to be consistently higher than non treated.
- Surface runoff results showed considerable variability with no apparent trend.
- PH is greater by 0.14 which translates to a 26.89% increase in basicity for magnetically treated water.
- Surface tension qualitatively appears to have increased. On average capillary rise was 5.2 cm higher on MTW

Methods / Equipment

- Dynamic viscosity was measured using a BROOKFIELD AMTEK DV-1 viscometer RV-02 at 20 rpm
- Surface tension was assessed qualitatively through capillarity of silt loom soil. In a tube. Water height was kept consistent.
- Density was assessed using a pycnometer by method of specific gravity at 23° C
- pH was measured using METTER TOLEDO Five Easy Plus pH meter
- Throw distance measured using 2 impact sprinklers at 50 psi one treated one non treated.
- Surface runoff was collected from the base of each 22 x 35-foot plot.

Conclusions

Based on our current understanding of soil/water interactions and hydraulic processes the direction of these changes does not explain observed changes in infiltration, sprinkler throw distance, and increased flow through nozzles. Additional water properties may need to be considered, methodology may need to be improved or better instrumentation might be needed to better explain the relationship between property changes and observed field results

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Sources

1. A Comparison of Physio-Chemical and Microbiological Properties of Tap and Bottled Drinking Water in Saudi Arabia. (2020). *Journal of Chemical, Biological and Physical Sciences, 10*(3). doi:10.24214/jcbps.d.10.3.32543
2. Effect of Magnetic Treatment on Surface Tension and Water Evaporation. (2013). *International Journal of Advance Industrial Engineering, 5*(3), 119-124. doi:10.14741/ijae/5.3.4
3. Chibowski, Emil & Szcześ, Aleksandra & Hołysz, Lucyna. (2018). Influence of Magnetic Field on Evaporation Rate and Surface Tension of Water. Colloids and Interfaces. 2. 68. 10.3390/colloids2040068.
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