



Healthy Hemp Research LLC
3208A W Co Rd 54G,
Laporte, CO, 80535
healthyhempresearch@gmail.com
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Scientific analysis of GREASE™ as a soil conditioner affecting infiltration rate

The Method of Water Drop Penetration Test (WDPT), and Molarity of Ethanol Droplet Test (MED) for analyzing water repellency in soil.
By Healthy Hemp Research LLC for Fractal Growth LLC

GREASE is a product that contains cannabinoid extracts as an active ingredient in medical grade ethanal and water as carrier agents. The hypothesis was that the structural components of the cannabinoid extracts would help the soil through chemical bonding and increase the infiltration rate. Two controlled experiments were conducted gather data and test this hypothesis.

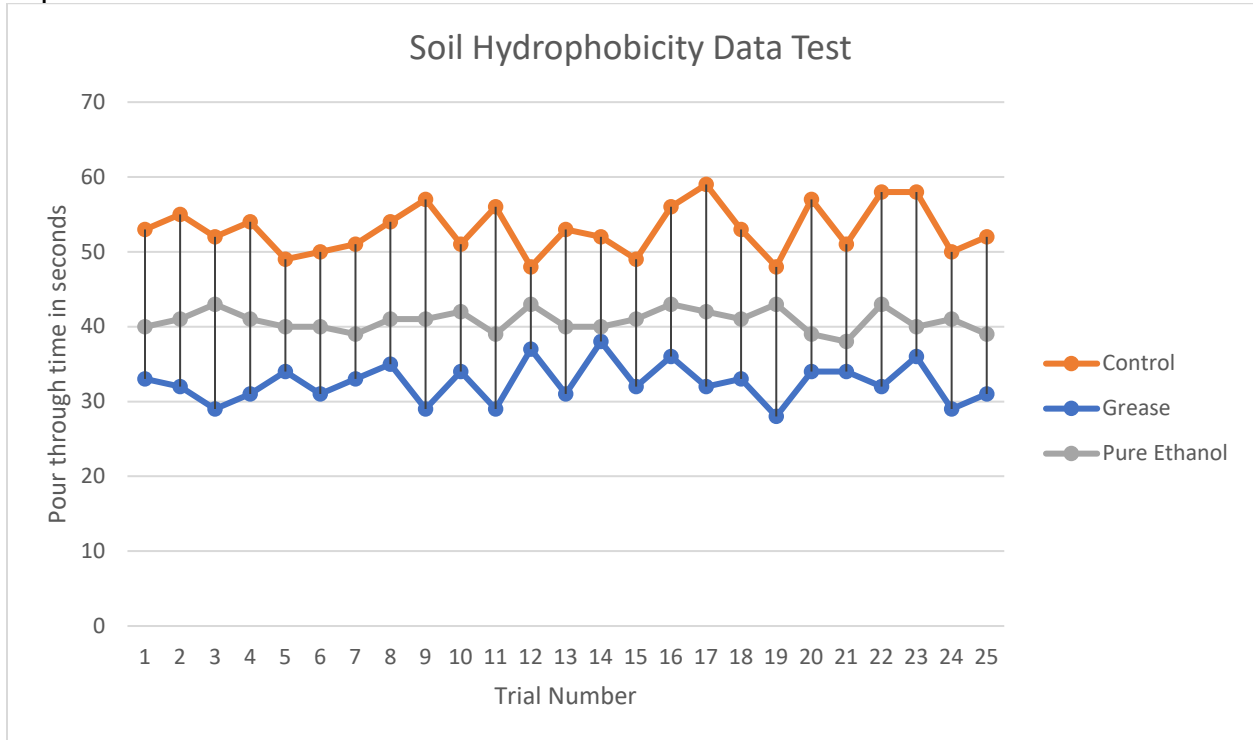
The soil hydrophobicity test data points are a water drop penetration time(WPDT) test, with a controlled experimental design. The test was conducted on September 1, 2020 in an approved laboratory setting at a consistent 75 degrees Fahrenheit. The procedure was as follows: 25 to 30 g samples were taken out of the same sample peat based soil(Biobizz Light-Mix) and put on a horizontal surface[Letey, 1969; King 1981]. The samples were leveled and a small 2-3mm drop of water for the control, or GREASE™ as the treatments, was added to the surface of the soil. The time for the drop to infiltrate was recorded. The test was replicated 25 times until a consistent reading was obtained. Water repellency was classified according to Table 1. To ensure uniformity of sampling water repellency was determined with the WDPT method on soil that was moist, air dried, and finally oven dried at 105 degrees Celsius. (Steenhuis 2001)

Table1. Definition of water repellency classes.

Class	Time for Water to Infiltrate (sec)	Description
0	0-5	not water repellent
1	5-60	slightly water repellent
2	60-600	moderately water repellent
3	600-3600	severely water repellent
4	➤ 3600	extremely water repellent

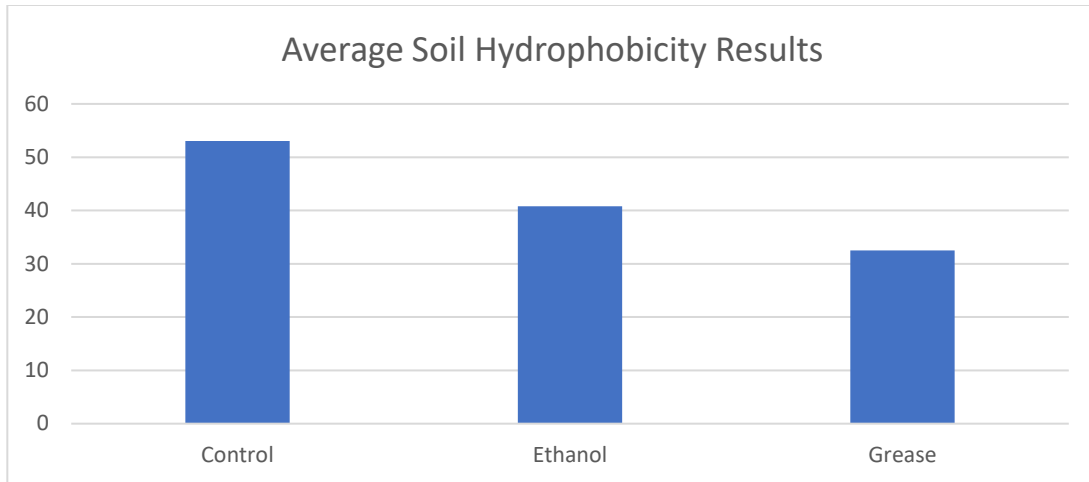
(Steenhuis 2001)

These data collected shows a consistent reading across 25 trials. The average control took 53.04 seconds and is defined by Table 1 as a class 1 soil response of slightly water repellent. The average GREASE™ treatment took 32.52 seconds to infiltrate the soil making it a class 2 repellency class and the soil response was moderately water repellent. This difference in water repellency class is the proof that all labels of GREASE™ are affecting the soil by making it less water repellent. This is useful and valuable as a wetting agent, breaking the surface tension of the soil and increasing infiltration rate. Testing data displayed graphically shows GREASE™ as a drench to improve the infiltration rate of the soil.



Data collected: 9/1/2020

The average soil hydrophobicity results show a clear difference between the Control, plain Ethanol, and GREASE™ treatments. Please see data points below:



The scientific research shows the functionality of GREASE™ by Fractal Growth may be considered a soil conditioner. These statements were made with the collection and interpretation of data from standardized experiments taken from Carter, D. J. (2002) Water repellence. In, N.J. McKenzie et al. Soil Physical Measurement and Interpretation for Land Evaluation, CSIRO Publishing, Collingwood. The Molarity of Ethanol Droplet (MED) test for water repellency rating of soil proves the addition of GREASE™ will increase the severity of reaction and aid in the breakdown of surface tension of the soil. The control showed no apparent severity. With the addition of GREASE™, cannabinoid latent ethanol miscible in water, the change in soil hydrophobicity resulted in a clear low change in severity at .35. Please reference the water repellence rating chart below:

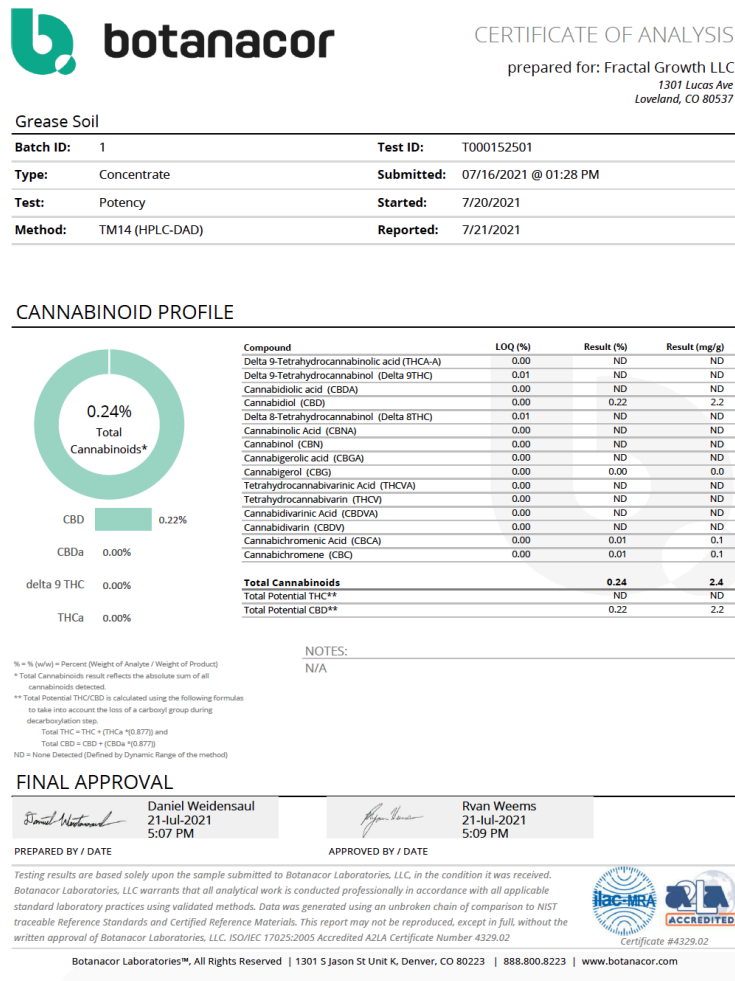
Water Repellant Rating

Molarity of Ethanol	Description of Severity
0	Not apparent
0.1-1.1	Low
1.1-2.3	Moderate
2.3-3.5	Severe
>3.5	Very Severe

The data shows this is chemically altering the soil with the addition of cannabinoid extracts showing it is increasing the infiltration rate. Additionally, despite being a non-polar compound, weak chemical bonding and interaction with soil aggregates is observed.

Laboratory test results using AAPFCO approved procedures shows the presences of cannabinoids in soil samples that were treated with Grease providing unique soil characteristics and chemistry. The goal of this test was to indicate the presence of cannabinoids in the soil after treatments with Grease. Organic peat based Biobizz Light-Mix soil was used in the experiment. Three treatments of one gallon were made three days apart at 60mL of Grease per one gallon of water and then the soil was sent in for analysis. The certificate of analysis in Figure 1 shows .24% total cannabinoids present in the sample.

Figure 1. Certificate of Analysis for soil sample treated with Grease



Certifying Scientist
/MichaelWalsh/
Healthy Hemp Research LLC

References:

- King, P.M. 1981. Comparison of methods for measuring severity of water repellence of sandy soils and assessment of some factors that affect its measurements. *Aust. J. Soil Res.* 19:275-285.
- Letey, J. 1969. Measurement of contact angle, water drop penetration time, and critical surface tension. *Proc. Symp. Water Repellent Soils. Univ. Cali., Riverside, CA.* pp. 43-47.
- N.J. McKenzie et al. *Soil Physical Measurement and Interpretation for Land Evaluation*, CSIRO Publishing, Collingwood
- Steenhuis, T.S. 2001, 'Water Repellency in New York State Soils', *International Turfgrass Society Research Journal*, vol. 9, pp. 624-625.