



## What is a Perc Test?

In brief, a perc test measures soil's moisture absorption rate. More specifically, a perc test determines how long it takes for the soil to drain moisture added to the ground. Perc tests are often important for any property that utilizes a septic system, as perc tests can help determine the best place to install a drain, leach field, or other septic system elements.

The idea was to test if EA treated water, either well water or city water would respond to deeper soil penetration.

The key is to treat the water to a Negative – ORP.

<https://vimeo.com/710562271/4e459c471a>

It appears there is good effect. Worth looking into further.

Here is a summary of the results:

### Water percolation test Centimeters rate in 60 minutes

	yard/packed	Not tilled soil	conventional soil	Average % increase
<b>Well</b>				
Water	2.13	1.97	2.67	
EA well	3.23	3.23	3.47	
% Increase	51.62	63.95	29.96	48.51
<b>City</b>				
Water	2.43	1.57	2.4	
EA city	2.8	3.57	2.47	
% Increase	15.22	127.39	2.90%	47.55

Talbott Howard COO Electro-Aeration.

Dr. Louie Lin, Advisor Director of Surface Water Institute, Christian Brothers University

Dr. Kirksey AgriCenter International Tennessee

Accepted by Nick Eckelberry For Electro-Aeration Inc.

Electro-Aeration™ Incorporated  
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## Agricenter International

### 2022 Electro-Aerated Water Effects on Soil Percolation

Trial ID: 2022 Electro-Aeration Perc Test Location: Agricenter International Trial Year: 2022  
Protocol ID: 2022 Electro-Aeration Perc Test Investigator (Creator): Bruce Kirksey  
Project ID: Study Director: Dr. K. Bruce Kirksey  
Sponsor Contact: Talbott Howard

#### General Trial Information

**Study Director:** Dr. K. Bruce Kirksey **Title:** Director of Research

**Trial Status:** E established

**ARM Trial Created On:** 5/12/2022

#### Trial Location

**City:** Memphis **Country:** USA United States

**State/Prov.:** Tennessee

**Postal Code:** 38120 **Climate Zone:** EPPOSE EPPO South East

**Conducted Under GLP:** No

**Conducted Under GEP:** No

#### Objectives:

### Soil Percolation and potential remedying soil compaction: (Perc Test)

*Abstract: Nano-bubble formation will better penetrate soil due to water droplet size and, with the addition of organic amendments, have a long-lasting effect on remediation of stratification due to drought cycles.*

#### Questions:

1. How effective is the nano-bubble at assisting percolation?
2. At what depth does the “nano-bubble” effect last?
3. EA use with Biochar as a remediation tool?
4. Other organic amendments in combination with EA water?

Instrumentation: Soil Compaction meter (digital or analog)

#### Data to collect:

1. Percolation rate in cm/hr (12" hole fill with different water types)

Soil tensiometer readings

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Reps: 3                      Plots: 5 by 5 feet  
 Appl. Amount: 10 GAL/AC                      Mix Size: .06518 L (total for 3 plots; minimum=.06518 L)

Trt No.	Treatment Name	Amt Product to Measure	Rep		
			1	2	3
1	City Water Yard		101	202	302
2	City Water No-till		102	201	301
3	City Water Conventional		103	203	303
4	Well Water Yard		104	211	310
5	Well Water No-till		105	210	311
6	Well Water Conventional		106	212	312
7	Electro-Aerated City Water Yard		107	205	307
8	Electro-Aerated City Water No-till		108	204	308
9	Electro-Aerated City Water Conventional		109	206	309
10	Electro-Aerated Well Water Yard		110	207	306
11	Electro-Aerated Well Water No-till		111	208	304
12	Electro-Aerated Well Water Conventional		112	209	305

Sort Order: Treatment

Product quantities required for listed treatments and applications of trials included in this table:

Amount*	Unit	Treatment Name	Form Conc	Form Unit	Form Type	Lot Code
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\* Product amount calculations increased 25 % for overage adjustment.



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Project ID: Study Director: Dr. K. Bruce Kirksey  
Sponsor Contact: Talbott Howard

#### Contacts

**Role:** STYDIR study director  
**Study Director:** Dr. K. Bruce Kirksey **Title:** Director of Research  
**Organization:** Agricenter International  
**Address 1:** 7777 Walnut Grove Road **Phone No.:** 901-757-7754 **Mobile No.:** 901-355-9124  
**Country:** USA United States **E-mail:** bkirksey@agricenter.org  
**City:** Memphis **State/Prov:** TN **Postal Code:** 38120  
**Role:** SPONSR sponsor  
**Sponsor:** Talbott Howard **Title:** COO  
**Organization:** Electro-Aeration, Inc. **Mobile No.:** 901-734-3982  
**E-mail:** talbott@electroaeration.com

#### Site and Design

**Treated Plot Width:** 5 FT **Site Type:** FIELD field  
**Treated Plot Length:** 5 FT  
**Treated Plot Area:** 25.0 FT<sup>2</sup> **Treatments:** 12  
**Replications:** 3 **Study Design:** SPLPLO Split-Plot

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 Project ID:      Study Director: Dr. K. Bruce Kirksey  
 Sponsor Contact: Talbott Howard

Description		INITIAL	INITIAL+15 MIN	INITIAL+30 MIN	INITIAL+60 MIN	PERC RATE 15 MIN	
Rating Date		5/12/2022	5/12/2022	5/12/2022	5/12/2022		
Part Rated		HOLE, C	HOLE, C	HOLE, C	HOLE, C		
Rating Type		WATER PER	WATER PER	WATER PER	WATER PER	CM/15 MIN	
Rating Unit/Min/Max		cm, -, -	cm, -, -	cm, -, -	cm, -, -	cm, -, -	
Number of Subsamples		1	1	1	1	1	
Trt	Treatment						
No.	Name	Plot	1	2	3	4	5
1	City Water Yard	101	25.00	24.40	24.000	23.00	0.60
		202	25.40	24.80	24.100	22.90	0.60
		302	25.70	23.50	23.200	22.90	2.20
		Mean =	25.37	24.23	23.767	22.93	1.13
2	City Water No-till	102	20.00	19.50	19.500	19.50	0.50
		201	21.00	20.00	19.300	18.80	1.00
		301	21.00	20.00	19.000	19.00	1.00
		Mean =	20.67	19.83	19.267	19.10	0.83
3	City Water Conventional	103	23.50	23.00	22.000	21.00	0.50
		203	21.00	20.00	19.000	18.80	1.00
		303	25.50	24.00	23.000	23.00	1.50
		Mean =	23.33	22.33	21.333	20.93	1.00
4	Well Water Yard	104	25.40	24.10	22.500	22.20	1.30
		211	25.40	24.90	24.400	23.50	0.50
		310	25.40	24.90	24.400	24.10	0.50
		Mean =	25.40	24.63	23.767	23.27	0.77
5	Well Water No-till	105	20.00	19.00	19.000	18.00	1.00
		210	19.50	19.00	18.500	17.60	0.50
		311	19.50	19.00	18.000	17.50	0.50
		Mean =	19.67	19.00	18.500	17.70	0.67
6	Well Water Conventional	106	24.00	23.00	21.800	21.00	1.00
		212	25.00	24.50	23.000	22.50	0.50
		312	21.00	20.00	19.600	18.50	1.00
		Mean =	23.33	22.50	21.467	20.67	0.83
7	Electro-Aerated City Water Yard	107	23.50	22.40	21.900	21.30	1.10
		205	24.10	23.50	22.900	21.20	0.60
		307	25.40	24.80	24.400	22.10	0.60
		Mean =	24.33	23.57	23.067	21.53	0.77
8	Electro-Aerated City Water No-till	108	20.00	17.50	16.500	15.80	2.50
		204	20.00	18.50	18.000	17.50	1.50
		308	20.00	19.00	18.000	16.00	1.00
		Mean =	20.00	18.33	17.500	16.43	1.67
9	Electro-Aerated City Water Conventional	109	20.50	19.00	18.300	17.30	1.50
		206	24.00	23.00	22.000	21.80	1.00
		309	22.00	21.00	20.500	20.00	1.00
		Mean =	22.17	21.00	20.267	19.70	1.17
10	Electro-Aerated Well Water Yard	110	26.00	24.10	23.500	22.90	1.90
		207	25.40	22.90	22.200	21.60	2.50
		306	26.00	24.80	23.500	23.20	1.20
		Mean =	25.80	23.93	23.067	22.57	1.87
11	Electro-Aerated Well Water No-till	111	21.00	18.50	18.000	17.00	2.50
		208	20.00	18.00	17.500	16.80	2.00
		304	20.00	18.00	18.000	17.50	2.00
		Mean =	20.33	18.17	17.833	17.10	2.17
12	Electro-Aerated Well Water Conventional	112	20.50	19.50	18.500	17.30	1.00
		209	28.50	25.00	24.000	23.80	3.50
		305	23.50	22.50	21.750	21.00	1.00
		Mean =	24.17	22.33	21.417	20.70	1.83

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Protocol ID: 2022 Electro-Aeration Perc Test	Investigator (Creator): Bruce Kirksey	
Project ID:	Study Director: Dr. K. Bruce Kirksey	
	Sponsor Contact: Talbott Howard	

Description		PERC RATE 30 MIN	PERC RATE 60 MIN
Rating Date			
Part Rated			
Rating Type		CM/30 MIN	CM/60 MIN
Rating Unit/Min/Max		cm, -, -	cm, -, -
Number of Subsamples		1	1
Trt Treatment			
No. Name	Plot	6	7
1 City Water	101	1.000	2.00
Yard	202	1.300	2.50
	302	2.500	2.80
	Mean =	1.600	2.43
2 City Water	102	0.500	0.50
No-till	201	1.700	2.20
	301	2.000	2.00
	Mean =	1.400	1.57
3 City Water	103	1.500	2.50
Conventional	203	2.000	2.20
	303	2.500	2.50
	Mean =	2.000	2.40
4 Well Water	104	2.900	3.20
Yard	211	1.000	1.90
	310	1.000	1.30
	Mean =	1.633	2.13
5 Well Water	105	1.000	2.00
No-till	210	1.000	1.90
	311	1.500	2.00
	Mean =	1.167	1.97
6 Well Water	106	2.200	3.00
Conventional	212	2.000	2.50
	312	1.400	2.50
	Mean =	1.867	2.67
7 Electro-Aerated City Water	107	1.600	2.20
Yard	205	1.200	2.90
	307	1.000	3.30
	Mean =	1.267	2.80
8 Electro-Aerated City Water	108	3.500	4.20
No-till	204	2.000	2.50
	308	2.000	4.00
	Mean =	2.500	3.57
9 Electro-Aerated City Water	109	2.200	3.20
Conventional	206	2.000	2.20
	309	1.500	2.00
	Mean =	1.900	2.47
10 Electro-Aerated Well Water	110	2.500	3.10
Yard	207	3.200	3.80
	306	2.500	2.80
	Mean =	2.733	3.23
11 Electro-Aerated Well Water	111	3.000	4.00
No-till	208	2.500	3.20
	304	2.000	2.50
	Mean =	2.500	3.23
12 Electro-Aerated Well Water	112	2.000	3.20
Conventional	209	4.500	4.70
	305	1.750	2.50
	Mean =	2.750	3.47



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#### Part Rated

HOLE = hole

C = Crop is Part Rated

Rating Unit/Min/Max

cm, , = centimeter

ARM Action Codes

T1 = [1]-[2]

T2 = [1]-[3]

T3 = [1]-[4]

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Description	INITIAL 5/12/2022 HOLE, C WATER PER cm, -, -	INITIAL+15 MIN 5/12/2022 HOLE, C WATER PER cm, -, -	INITIAL+30 MIN 5/12/2022 HOLE, C WATER PER cm, -, -	INITIAL+60 MIN 5/12/2022 HOLE, C WATER PER cm, -, -	PERC RATE 15 MIN CM/15 MIN cm, -, -	PERC RATE 30 MIN CM/30 MIN cm, -, -
Rating Date	5/12/2022	5/12/2022	5/12/2022	5/12/2022		
Part Rated	HOLE, C	HOLE, C	HOLE, C	HOLE, C		
Rating Type	WATER PER	WATER PER	WATER PER	WATER PER		
Rating Unit/Min/Max	cm, -, -	cm, -, -	cm, -, -	cm, -, -		
Number of Subsamples	1	1	1	1	1	1
Trt Treatment No. Name	1	2	3	4	5	6
1 City Water Yard	25.37 a	24.23 a	23.767 a	22.93 a	1.13 b-e	1.600 bc
2 City Water No-till	20.67 cd	19.83 cde	19.267 cde	19.10 bc	0.83 de	1.400 c
3 City Water Conventional	23.33 abc	22.33 abc	21.333 bc	20.93 ab	1.00 cde	2.000 abc
4 Well Water Yard	25.40 a	24.63 a	23.767 a	23.27 a	0.77 e	1.633 bc
5 Well Water No-till	19.67 d	19.00 de	18.500 de	17.70 cd	0.67 e	1.167 c
6 Well Water Conventional	23.33 abc	22.50 ab	21.467 abc	20.67 ab	0.83 de	1.867 abc
7 Electro-Aerated City Water Yard	24.33 ab	23.57 a	23.067 ab	21.53 ab	0.77 e	1.267 c
8 Electro-Aerated City Water No-till	20.00 d	18.33 e	17.500 e	16.43 d	1.67 a-d	2.500 ab
9 Electro-Aerated City Water Conventional	22.17 bcd	21.00 bcd	20.267 cd	19.70 bc	1.17 b-e	1.900 abc
10 Electro-Aerated Well Water Yard	25.80 a	23.93 a	23.067 ab	22.57 a	1.87 ab	2.733 a
11 Electro-Aerated Well Water No-till	20.33 d	18.17 e	17.833 e	17.10 cd	2.17 a	2.500 ab
12 Electro-Aerated Well Water Conventional	24.17 ab	22.33 abc	21.417 abc	20.70 ab	1.83 abc	2.750 a
LSD P=.05	2.864	2.537	2.3888	2.663	0.853	1.0157
Standard Deviation	1.655	1.466	1.3801	1.538	0.493	0.5868
CV	7.23	6.77	6.59	7.61	40.23	30.2
Grand Mean	22.881	21.656	20.9375	20.219	1.225	1.9431
Levene's F^	1.121	0.728	0.517	0.863	0.447	0.378
Levene's Prob(F)	0.388	0.702	0.873	0.585	0.917	0.952
Rank X2	.	.	.	.	.	.
P(Rank X2)	.	.	.	.	.	.
Skewness^	0.1343	-0.5646	-0.5046	-0.3948	0.999*	0.7954*
Kurtosis^	2.6847*	0.6678	0.3391	0.7858	1.6702*	0.41
Replicate F	0.750	1.067	1.111	1.094	0.374	0.519
Replicate Prob(F)	0.4882	0.3674	0.3533	0.3585	0.6939	0.6047
Treatment F	5.554	7.616	8.073	6.540	3.329	2.753
Treatment Prob(F)	0.0011	0.0002	0.0001	0.0004	0.0146	0.0324

Means followed by same letter or symbol do not significantly differ (P=.05, LSD).  
 Mean separations are based on the complete error term.  
 Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.  
 ^Calculated from residual.



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Description	PERC RATE 60 MIN
Rating Date	
Part Rated	
Rating Type	CM/60 MIN
Rating Unit/Min/Max	cm, -, -
Number of Subsamples	1
Trt Treatment No. Name	7
1 City Water Yard	2.43 b-e
2 City Water No-till	1.57 e
3 City Water Conventional	2.40 cde
4 Well Water Yard	2.13 de
5 Well Water No-till	1.97 de
6 Well Water Conventional	2.67 a-d
7 Electro-Aerated City Water Yard	2.80 a-d
8 Electro-Aerated City Water No-till	3.57 a
9 Electro-Aerated City Water Conventional	2.47 b-e
10 Electro-Aerated Well Water Yard	3.23 abc
11 Electro-Aerated Well Water No-till	3.23 abc
12 Electro-Aerated Well Water Conventional	3.47 ab
LSD P=.05	1.066
Standard Deviation	0.616
CV	23.15
Grand Mean	2.661
Levene's F^	0.332
Levene's Prob(F)	0.97
Rank X2	.
P(Rank X2)	.
Skewness^	-0.047
Kurtosis^	-0.4193
Replicate F	0.514
Replicate Prob(F)	0.6074
Treatment F	3.061
Treatment Prob(F)	0.0209

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Mean separations are based on the complete error term.  
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#### Part Rated

HOLE = hole

C = Crop is Part Rated

#### Rating Unit/Min/Max

cm, , = centimeter

#### ARM Action Codes

T1 = [1]-[2]

T2 = [1]-[3]

T3 = [1]-[4]