Analysis of 2012 Flowform Research

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Introduction

A series of tests was carried out at the Healing Water Institute from February to April 2012 to test the effectiveness of the Flowform Method in treating water. Wheat and cress were germinated and grown under controlled conditions with different treatment methods described below. This paper describes an appraisal of the results using analysis of variance based on the raw data. The five one-hour treatments compared were

- S: hand-stirred tap water
- TC: tap water control circulated using only a pump
- TF: tap water circulated through a Flowform
- PC: PearTree Well water control circulated using only a pump
- PF: PearTree Well water circulated through a Flowform

The difference between PearTree Well water and tap water was so great that no statistical analysis is necessary to see the difference. The analysis of variance gave 100% confidence that the treatments were different, as might be expected. Only one example of that analysis is shown below. Consequently the data was re-organised as follows:

- tap water for wheat, including S TC and TF data
- tap water for wheat, TC and TF only as S was often superior as might be expected
- tap water for cress, S TC and TF
- PearTree Well water for wheat i.e. PC and PF only
- PearTree Well water for cress, PC and PF only

The wheat analysis shows most results with high confidence levels. However treating the series of tests over three months as replicates is questionable as there is 100% confidence that they differ, so it is preferable to regard the tests as independent. Thus wheat is a good indicator, although the Flowform was not always the "best".

The cress results were not good. For the PearTree Well water the overall confidence level is only 76% when the tests are treated as replicates. Taking the tests separately showed only a few tests with high confidence level. The tap water results were poor, only four being significant. So it seems cress is not a good indicator.

Generally a confidence level of 95% is considered the minimum to be significant.

There appear to be uncontrolled influences at work as the Flowform was not always "best", and rather more tests showed an insignificant result than seems desirable. But the residual variance was not unduly high. The fact that the replicates differed with 100% confidence may indicate that factors to consider are temperature, illumination and time of day when the water was treated. A graph of Flowform effectiveness against the phase of the Moon showed no correlation.

The most striking and safe conclusion is that the PearTree Well water is strikingly better than tap water with 100% confidence. It might be worthwhile preparing a report for the producers.

Analysis Results

Example including all five treatments for wheat

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Analysis of Variance Results for wheat_120223_STCTFPCPF
Standard Analysis

Source        Sum       Degrees
of            of        of        Variance           Confidence
Variation     Squares   Freedom   Estimate   F       Level %

Treatment    446873.7         4    111718.4  119.67   100.000
Residual     343560.5       368      933.6
Total        790434.2       372

Table of Means
Treatment       S     TC     TF     PC     PF     Total
Mean          63.15  58.61  60.54 121.48 139.46  89.33
```

The confidence is 100% because treatments 4 and 5 (PearTree Well water) are obviously very different. It is of no value to analyse any further examples for all five treatments as the difference is obvious, and masks the comparisons of TC and TF, and PC and PF.

Wheat with tap water, all replicates

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Analysis of Variance Results for tapwaterWheatAll
Standard Analysis

Source        Sum       Degrees
of            of        of        Variance           Confidence
Variation     Squares   Freedom   Estimate   F       Level %

Treatment      1888.4         2      944.2   5.78    98.822
Replicates   771059.4        13    59312.3  363.22   100.000
Residual     366439.4      2244      163.3
Total       1139387.2      2259

Table of Means
Replicates         1        2        3        4        5        6        7        8        9
Treatment
 S             30.19    72.34    63.15    19.88    25.99    18.85    18.37    15.71    18.45
 TC            31.77    58.73    58.61    23.33    20.39    13.50    20.44    14.31    12.25
 TF            24.73    68.84    60.54    22.18    28.63    19.17     9.02    12.49    12.68
Totals         28.75    66.37    60.74    21.82    25.01    17.53    16.82    14.15    14.77

10       11       12       13       14      Totals
26.98    14.55    14.06    18.14    17.08    29.15
21.10    14.57    11.20    14.14    15.02    27.24
22.49    18.00    16.12    19.96    20.50    29.22
23.47    15.87    14.14    17.05    17.47
```

Note that the "Totals" shown are not sums of rows or columns but the means including all replicates or all treatments.

There is a significant difference between treatments with an overall confidence of 98.8%. However there is a 100% confidence that the replicates are different, so the table of means for a separate analysis for each replicate is shown below, including the confidence for each:

Replicates	1	2	3	4	5	6	7	8	9
Treatment									
S	30.19	72.34	63.15	19.88	25.99	18.85	18.37	15.71	18.45
TC	31.77	58.73	58.61	23.33	20.39	13.50	20.44	14.31	12.25
TF	24.73	68.84	60.54	22.18	28.63	19.17	9.02	12.49	12.68
Totals	28.75	66.37	60.74	21.82	25.01	17.53	16.82	14.15	14.77
Confidence %	99.57	99.76	57.11	92.29	100.00	100.00	100.00	99.93	100.00

10	11	12	13	14	Totals
26.98	14.55	14.06	18.14	17.08	29.15
21.10	14.57	11.20	14.14	15.02	27.24
22.49	18.00	16.12	19.96	20.50	29.22
23.47	15.87	14.14	17.05	17.47	
99.64	98.78	99.97	99.99	99.99	

There are 6 cases where the Flowform is best, 5 where the stirred treatment is best and 1 where the control is best (ignoring the 57% and 92.29% confidence cases). Note that the confidence depends upon the degrees of freedom (not shown) which explains a high confidence with a seemingly small difference in the means in some cases. Because the stirred treatment is similar in efficacy to the Flowform case, the table for TC and TF is shown below:

Replicates	1	2	3	4	5	6	7	8	9
Treatment									
TC	31.77	58.73	58.61	23.33	20.39	13.50	20.44	14.31	12.25
TF	24.73	68.84	60.54	22.18	28.63	19.17	9.02	12.49	12.68
Totals	28.13	63.73	59.63	22.84	24.48	16.49	16.11	13.36	12.46
Confidence %	99.73	98.85	41.36	44.62	100.00	100.00	100.00	96.76	39.17

10	11	12	13	14	Totals
21.10	14.57	11.20	14.14	15.02	27.24
22.49	18.00	16.12	19.96	20.50	29.22
21.88	16.84	14.18	16.59	17.71	
57.30	93.26	99.98	100.00	99.98	

Thus removing the influence of the stirred treatment we see that 3 more cases have low confidence leaving 7 cases where the Flowform is best and 3 where the control is best.

There appears to be an uncontrolled source of variation as the Flowform is not always best, and there are rather more low confidence cases than one might wish. Omitting the stirred treatment also permits comparison of this problem with the PearTree Well water case below.

Wheat with PearTree Well water

Analysis of Variance Results for pearTreeWheatAll
Standard Analysis

Source of Variation	Sum of Squares	Degrees of Freedom	Variance Estimate	F	Confidence Level %
Treatment	13253.6	1	13253.6	9.57	99.556
Replicates	858238.6	12	71519.9	51.64	100.000
Residual	1644016.7	1187	1385.0		
Total	2515508.8	1200			

Again the replicates are different, so we show the table of means for separate analyses of the replicates:

Table of Means

Replicates	1	2	3	4	5	6	7	8	9
Treatment									
PC	137.61	121.48	136.13	170.37	134.47	99.44	95.41	101.43	116.95
PF	121.52	139.46	137.84	180.50	134.79	113.95	88.74	129.03	111.07
Totals	129.35	130.00	136.99	175.03	134.61	107.43	91.69	114.19	114.05
Confidence %	98.32	99.30	0.00	95.15	0.00	91.41	66.90	99.85	44.74

10	11	12	13	Totals
80.59	57.27	117.76	93.72	118.05
99.16	53.02	100.17	114.02	124.70
87.27	55.76	109.55	103.57	
94.09	60.91	98.52	98.97	

5 cases are insignificant and one inconclusive (91.41%), leaving 5 where the Flowform is best and 2 where the control is best. Again there appears to be an uncontrolled source of variation as the Flowform is not always best.

Cress with tap water, all replicates

The table below shows the results for cress treated with tap water:

```
Analysis of Variance Results for tapwaterCressAll
Standard Analysis

Source        Sum       Degrees
of            of        of        Variance           Confidence
Variation     Squares   Freedom   Estimate   F       Level %

Treatment      1277.5         2      638.7   1.92    77.129
Replicates   219978.4        10    21997.8  66.00   100.000
Residual     291642.4       875      333.3
Total        512898.3       887
```

This is a poor result, and again the replicates differ. Combining the replicates gives only a 48.7% confidence level. The table of means for separate analysis of the replicates is:

```
Table of Means
Replicates         1        2        3        4        5        6        7        8        9
Treatment
 S             86.96    59.33    57.93    77.68    72.11   109.49    97.96    49.20    53.33
 TC            81.90    54.27    58.82    58.97    68.21    98.76    86.85    56.35    54.22
 TF            89.67    54.81    58.57    68.69    67.98    96.68    87.85    69.13    48.24
Totals         86.10    56.17    58.44    67.86    69.41   101.47    91.03    58.25    51.90
Confidence %   51.19    79.41     5.77    98.54    33.79    97.37    90.04    99.66    52.98

10       11      Totals
66.92    74.31    73.35
72.86    83.38    70.45
75.74    84.85    72.27
71.65    80.90
80.11    97.67
```

Only 4 tests are significant, 2 for the Flowform and 2 for the stirred treatment.

Cress with PearTree Well water

The table below shows the results for cress treated with PearTree Well water:

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Analysis of Variance Results for pearTreeCressAll
Standard Analysis

Source        Sum       Degrees
of            of        of        Variance           Confidence
Variation     Squares   Freedom   Estimate   F       Level %

Treatment       386.5         1      386.5   1.96    76.270
Replicates   122047.0        10    12204.7  61.90   100.000
Residual     117110.4       594      197.2
Total        239543.8       605
```

Again the overall result is poor. Separating the replicates gives:

Table of Means

Replicates	1	2	3	4	5	6	7	8	9	10	11	Totals
Treatment												
PC	81.90	41.81	54.15	58.66	49.19	79.80	72.42	47.72	58.91	69.22	57.31	60.18
PF	89.67	46.68	46.76	65.21	47.96	91.45	69.02	57.02	48.81	65.28	59.53	61.78
Totals	85.70	44.24	50.51	61.72	48.59	85.62	70.72	52.47	53.97	67.16	58.42	
Confidence %	82.51	96.65	98.99	98.49	32.78	99.89	55.06	99.92	89.84	52.79	56.94	

There are 4 significant cases where the Flowform is better and 1 where the control is better.
It seems cress is not a good indicator.