|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| The following data represents the final counts of the numbers of alfalfa sprouts present under each of the conditions.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | |  | Number |  |  | Number |  |  | Number | | FA1 | 77 |  | SA1 | 86 |  | PA1 | 117 | | FA2 | 95 |  | SA2 | 64 |  | PA2 | 128 | | FA3 | 142 |  | SA3 | 62 |  | PA3 | 119 | | FA4 | 105 |  | SA4 | 110 |  | PA4 | 88 | | FA5 | 154 |  | SA5 | 135 |  | PA5 | 103 | | FA6 | 89 |  | SA6 | 114 |  | PA6 | 111 | | FA7 | 134 |  | SA7 | 94 |  | PA7 | 139 | | FA8 | 119 |  | SA8 | 68 |  | PA8 | 127 | | FA9 | 112 |  | SA9 | 71 |  | PA9 | 152 | | FA10 | 112 |  | SA10 | 81 |  | PA10 | 141 | | FA11 | 116 |  | SA11 | 107 |  | PA11 | 121 | | FA12 | 145 |  | SA12 | 84 |  | PA12 | 135 | | FA13 | 136 |  | SA13 | 92 |  | PA13 | 109 | | FA14 | 89 |  | SA14 | 144 |  | PA14 | 137 | | FA15 | 146 |  | SA15 | 115 |  | PA15 | 119 | | FA16 | 103 |  | SA16 | 138 |  | PA16 | 123 | | FA17 | 81 |  | SA17 | 139 |  | PA17 | 106 | | FA18 | 129 |  | SA18 | 108 |  | PA18 | 143 | | FA19 | 97 |  | SA19 | 89 |  | PA19 | 129 | | FA20 | 132 |  | SA20 | 120 |  | PA20 | 112 | | FA21 | 123 |  | SA21 | 97 |  | PA21 | 102 | | FA22 | 90 |  | SA22 | 111 |  | PA22 | 72 | | FA23 | 84 |  | SA23 | 94 |  | PA23 | 59 | | FA24 | 90 |  | SA24 | 95 |  | PA24 | 72 |   The following data represents a rough estimate of the average weight of each alfalfa sprout under the three diffrent lights.   |  |  |  |  | | --- | --- | --- | --- | | PA | FA | SA |  | | 15.45 g | 8.75 g | 6 g | total weight | | 2764 | 2700 | 2418 | # sprouts | | 0.0056 | 0.0032 | 0.0025 | average weight | | PO | FO | SO |  | | 1.9 g | 1.05 g | .9 g | total weight | | 41 | 39 | 33 | # sprouts | | 0.0463 | 0.0269 | 0.0273 | average weight | | PW | FW | SW |  | | 3.25 g | 3.5 g | 3.35 g | total weight | | 121 | 122 | 138 | # sprouts | | 0.0269 | 0.0287 | 0.0243 | average weight |   The following table represents all the statistical tests that were done on our data to determine statistical significance.  Tests on the numbers of the alfalfa sprouts showed a significantly higher number under the plant light than the saran wrap light, and higher under the fluorescent light than under the saran wrap light  Daily measurements of the tallest oat plants showed no significance, as did the number of sprouts under each light. However, the final measurements of all oat plants showed a statistically significance difference: the fluorescent was taller than both the saran wrap and the plant lights.  The earlier daily measurements of the wheat plants showed that the plant light wheat was significantly taller than both the saran wrap and the fluorescent. However, the fluorescent "caught up" by the end of the data collection and the difference was no longer statistically significant. Contrary to our hypothesis, the fluorescent wheat was significantly taller than the saran wrap wheat throughout (the starred p-values show tests resulting in an outcome opposite what was expected). Final data collection on all wheat plants showed a statistically significant difference between all three types. The plant light was taller than the fluorescent and the saran, while the fluorescent was taller than the saran as well.  Tests on the roots of both the oat and the wheat showed no difference, supporting our hypothesis (roots are not exposed to the light and therefore not exposed to the differing levels of UV).   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Statistical | Analysis |  |  |  |  |  |  | | Ho | Ha | x1, x2 | t | df | p | Conclusions |  | | # PA=SA | # PA>SA | 115.17,100.75 | 2.104 | 46 | 0.02 | reject |  | | # PA=FA | # PA>FA | 115.17,112.5 | 0.393 | 46 | 0.348 | fail to reject |  | | # FA=SA | # FA>SA | 112.5,100.75 | 1.73 | 46 | 0.045 | reject |  | | H PO=SO | H PO>SO | 3.05,3.24 | -0.581 | 35 | 0.718 | fail to reject | (4/12) | | H PO=FO | H PO>FO | 3.05,3.51 | -1.25 | 37 | 0.89 | fail to reject | (4/12) | | H SO=FO | H SO>FO | 3.24,3.51 | -0.906 | 36 | 0.815 | fail to reject | (4/12) | | H PO=SO | H PO>SO | 3.74,3.91 | -0.407 | 36 | 0.657 | fail to reject | (4/13) | | H PO=FO | H PO>FO | 3.74,4.53 | -1.85 | 38 | \*0.964\* | fail to reject | (4/13) | | H SO=FO | H SO>FO | 3.91,4.53 | -2.01 | 36 | \*0.974\* | fail to reject | (4/13) | | H PO=SO | H PO>SO | 4.59,4.89 | -0.72 | 36 | 0.762 | fail to reject | (4/14) | | H PO=FO | H PO>FO | 4.59,5.17 | -1.36 | 37 | 0.909 | fail to reject | (4/14) | | H SO=FO | H SO>FO | 4.89,5.17 | -0.96 | 35 | 0.829 | fail to reject | (4/14) | | H PO=SO | H PO>SO | 9.83,5.54 | 1.04 | 34 | 0.152 | fail to reject | (4/15) | | H PO=FO | H PO>FO | 9.83,5.92 | 0.98 | 35 | 0.167 | fail to reject | (4/15) | | H SO=FO | H SO>FO | 5.54,5.92 | -0.941 | 37 | 0.874 | fail to reject | (4/15) | | H PO=SO | H PO>SO | 6.17,6.29 | -0.269 | 36 | 0.605 | fail to reject | (4/16) | | H PO=FO | H PO>FO | 6.17,5.99 | 0.382 | 38 | 0.382 | fail to reject | (4/16) | | H SO=FO | H SO>FO | 6.29,5.99 | 0.63 | 38 | 0.266 | fail to reject | (4/16) | | H PO=SO | H PO>SO | 6.32,6.56 | -0.62 | 37 | 0.73 | fail to reject | (4/17) | | H PO=FO | H PO>FO | 6.32,6.46 | -0.334 | 39 | 0.63 | fail to reject | (4/17) | | H SO=FO | H SO>FO | 6.56,6.46 | 0.229 | 38 | 0.41 | fail to reject | (4/17) | | H PO=SO | H PO>SO | 6.71,6.71 | 0.006 | 37 | 0.497 | fail to reject | (4/18) | | H PO=FO | H PO>FO | 6.71,6.56 | 0.405 | 39 | 0.344 | fail to reject | (4/18) | | H SO=FO | H SO>FO | 6.71,6.56 | 0.349 | 38 | 0.364 | fail to reject | (4/18) | | H PO=SO | H PO>SO | 6.83,6.85 | -0.066 | 35 | 0.526 | fail to reject | (4/19) | | H PO=FO | H PO>FO | 6.83,6.65 | 0.535 | 39 | 0.298 | fail to reject | (4/19) | | H SO=FO | H SO>FO | 6.85,6.65 | 0.489 | 36 | 0.314 | fail to reject | (4/19) | | # PO=SO | # PO>SO | 2.05,1.74 | 0.982 | 37 | 0.166 | fail to reject |  | | # PO=FO | # PO>FO | 2.05,1.77 | 0.935 | 40 | 0.177 | fail to reject |  | | # SO=FO | # SO>FO | 1.74,1.77 | -0.127 | 39 | 0.55 | fail to reject |  | | H PW=SW | H PW>SW | 8.75,7.40 | 5.68 | 46 | 0.000000568 | reject | (4/12) | | H PW=FW | H PW>FW | 8.75,8.15 | 2.96 | 46 | 0.002 | reject | (4/12) | | H SW=FW | H SW>FW | 7.40,8.15 | -2.67 | 46 | \*0.995\* | fail to reject | (4/12) | | H PW=SW | H PW>SW | 9.18,8.10 | 4.71 | 46 | 0.0000116 | reject | (4/13) | | H PW=FW | H PW>FW | 9.18,8.66 | 2.58 | 46 | 0.007 | reject | (4/13) | | H SW=FW | H SW>FW | 8.10,8.66 | -2.15 | 46 | \*0.982\* | fail to reject | (4/13) | | H PW=SW | H PW>SW | 9.33,8.40 | 4.23 | 46 | 0.0000545 | reject | (4/14) | | H PW=FW | H PW>FW | 9.33,9.03 | 1.41 | 46 | 0.083 | fail to reject | (4/14) | | H SW=FW | H SW>FW | 8.40,9.03 | -2.44 | 46 | \*0.991\* | fail to reject | (4/14) | | H PW=SW | H PW>SW | 9.47,8.77 | 3.16 | 46 | 0.001 | reject | (4/15) | | H PW=FW | H PW>FW | 9.47,9.28 | 0.856 | 46 | 0.198 | fail to reject | (4/15) | | H SW=FW | H SW>FW | 8.77,9.28 | -1.94 | 46 | \*0.971\* | fail to reject | (4/15) | | H PW=SW | H PW>SW | 9.60,8.93 | 2.85 | 46 | 0.003 | reject | (4/16) | | H PW=FW | H PW>FW | 9.60,9.29 | 1.39 | 46 | 0.086 | fail to reject | (4/16) | | H SW=FW | H SW>FW | 8.93,9.29 | -1.37 | 46 | 0.911 | fail to reject | (4/16) | | H PW=SW | H PW>SW | 9.68,9.04 | 3.13 | 46 | 0.002 | reject | (4/17) | | H PW=FW | H PW>FW | 9.68,9.48 | 0.95 | 46 | 0.172 | fail to reject | (4/17) | | H SW=FW | H SW>FW | 9.04,9.48 | -1.86 | 46 | \*0.965\* | fail to reject | (4/17) | | H PW=SW | H PW>SW | 9.875,9.18 | 3.13 | 46 | 0.001 | reject | (4/18) | | H PW=FW | H PW>FW | 9.875,9.53 | 1.62 | 46 | 0.056 | fail to reject | (4/18) | | H SW=FW | H SW>FW | 9.18,9.53 | -1.37 | 46 | 0.911 | fail to reject | (4/18) | | H PW=SW | H PW>SW | 9.94,9.21 | 3.16 | 46 | 0.001 | reject | (4/19) | | H PW=FW | H PW>FW | 9.94,9.55 | 1.8 | 46 | 0.04 | reject | (4/19) | | H SW=FW | H SW>FW | 9.21,9.55 | -1.32 | 46 | 0.903 | fail to reject | (4/19) | | # PW=SW | # PW>SW | 5.125,5.58 | -2.02 | 46 | \*0.975\* | fail to reject |  | | # PW=FW | # PW>FW | 5.125,5.29 | -0.622 | 46 | 0.732 | fail to reject |  | | # SW=FW | # SW>FW | 5.59,5.29 | 1.32 | 46 | 0.096 | fail to reject |  | | H PW=SW | H PW>SW | 7.42,6.32 | 3.65 | 257 | 0.0001595 | reject | (final) | | H PW=FW | H PW>FW | 7.42,6.87 | 1.75 | 241 | 0.041 | reject | (final) | | H SW=FW | H SW>FW | 6.32,6.87 | -1.74 | 258 | \*0.958\* | fail to reject | (final) | | H PO=SO | H PO>SO | 5.64,5.68 | -0.08 | 72 | 0.533 | fail to reject | (final) | | H PO=FO | H PO>FO | 5.64,6.39 | -1.81 | 78 | \*0.963\* | fail to reject | (final) | | H SO=FO | H SO>FO | 5.68,6.39 | -1.74 | 70 | \*0.957\* | fail to reject | (final) | | R PW=SW | R PW>SW | 6.15,5.86 | 1.25 | 257 | 0.106 | fail to reject | (final) | | R PW=FW | R PW>FW | 6.15,5.77 | 1.52 | 241 | 0.065 | fail to reject | (final) | | R SW=FW | R SW>FW | 5.86,5.77 | 0.35 | 258 | 0.365 | fail to reject | (final) | | R PO=SO | R PO>SO | 3.31,2.92 | 1.24 | 72 | 0.11 | fail to reject | (final) | | R PO=FO | R PO>FO | 3.31,3.34 | -0.104 | 78 | 0.54 | fail to reject | (final) | | R SO=FO | R SO>FO | 2.92,3.34 | -1.64 | 70 | 0.947 | fail to reject | (final) |   [(Data 1)](http://docs.google.com/data.html) [(Data 2)](http://docs.google.com/data2.html) [(Data 3)](http://docs.google.com/data3.html) [(Data 4)](http://docs.google.com/data4.html) [(Data 5)](http://docs.google.com/data5.html) [(Data 7)](http://docs.google.com/data7.html)  [[Home](http://docs.google.com/home.html)][[Introduction](http://docs.google.com/introduction.html)][[Hypothesis](http://docs.google.com/hypothesis.html)][[Procedure](http://docs.google.com/procedure.html)][[Data](http://docs.google.com/data.html)][[Conclusions](http://docs.google.com/conclusions.html)][[Bilio/Links](http://docs.google.com/biblio.html)]  [[2001 Projects](http://docs.google.com/index.html)][[2000 Projects](http://docs.google.com/AP2000/index.html)][[1999 Projects](http://docs.google.com/AP99/index.html)][[1998 Projects](http://docs.google.com/AP98/index.html)] |