

Appendix 12

ANOVA – Average RGB Values

Variance Due to Varying Drop Height

For each characteristic, ANOVA was performed using a 0.05 (5%) level of significance, i.e. if the p -value obtained was less than 0.05, there would be a significant level of variance.

1.1 Red Values

H_0 : There is no difference between the red values obtained as drop height is varied.

H_a : There is a difference between the red values obtained as drop height is varied.

Dataset Used For Calculation:

| Drop Height | 5 cm | 4 cm | 3cm |
|--------------------|-------|-------|-------|
| Average Red Values | 193.0 | 183.4 | 182.4 |
| | 198.6 | 195.0 | 202.2 |
| | 201.8 | 196.2 | 203.8 |
| | 172.3 | 173.0 | 172.3 |
| | 189.5 | 178.5 | 186.0 |
| | 157.7 | 158.0 | 160.3 |
| | 208.0 | 192.0 | 209.0 |
| | 194.8 | 191.6 | 195.5 |
| | 185.0 | 181.3 | 189.3 |
| | 176.0 | 171.0 | 171.0 |
| | 197.0 | 197.0 | 198.5 |
| | 195.0 | 190.5 | 191.0 |

Results:

| | | | | | | |
|----------------------------|--------------|------------|----------------|-----------------|----------------|---------------|
| Anova: Single Factor | | | | | | |
| SUMMARY | | | | | | |
| <i>Groups</i> | <i>Count</i> | <i>Sum</i> | <i>Average</i> | <i>Variance</i> | | |
| 5 cm | 12 | 2268.7 | 189.0583 | 200.9481 | | |
| 4 cm | 12 | 2207.5 | 183.9583 | 146.0663 | | |
| 3 cm | 12 | 2261.3 | 188.4417 | 218.6608 | | |
| ANOVA | | | | | | |
| <i>Source of Variation</i> | <i>SS</i> | <i>df</i> | <i>MS</i> | <i>F</i> | <i>P-value</i> | <i>F crit</i> |
| Between Groups | 185.9622 | 2 | 92.98111 | 0.493116 | 0.615149 | 3.284918 |
| Within Groups | 6222.428 | 33 | 188.5584 | | | |
| Total | 6408.39 | 35 | | | | |

Conclusion:

As the $p > 0.05$, H_0 is accepted and H_a rejected. Therefore there is no significant difference between the red values obtained as drop height is varied.

1.2 Green Values

H_0 : There is no difference between the green values obtained as drop height is varied.

H_a : There is a difference between the green values obtained as drop height is varied.

Dataset Used For Calculation:

| Drop Height | 5 cm | 4 cm | 3cm |
|--------------------|-------|-------|-------|
| Average Red Values | 184.4 | 173.8 | 156.8 |
| | 195.8 | 189.6 | 199.2 |
| | 199.2 | 190.0 | 200.8 |
| | 168.0 | 170.0 | 172.0 |
| | 183.0 | 172.5 | 183.5 |
| | 153.0 | 157.0 | 157.0 |
| | 205.5 | 191.0 | 208.5 |
| | 190.6 | 189.4 | 192.0 |
| | 180.0 | 177.3 | 185.3 |
| | 175.0 | 170.0 | 172.0 |
| | 192.0 | 191.5 | 192.0 |
| | 191.0 | 188.0 | 191.0 |

Results:

| | | | | | | |
|----------------------------|--------------|------------|----------------|-----------------|----------------|---------------|
| Anova: Single Factor | | | | | | |
| SUMMARY | | | | | | |
| <i>Groups</i> | <i>Count</i> | <i>Sum</i> | <i>Average</i> | <i>Variance</i> | | |
| 5 cm | 12 | 2217.5 | 184.7917 | 208.7936 | | |
| 4 cm | 12 | 2160.1 | 180.0083 | 129.8863 | | |
| 3 cm | 12 | 2210.1 | 184.175 | 277.1766 | | |
| | | | | | | |
| ANOVA | | | | | | |
| <i>Source of Variation</i> | <i>SS</i> | <i>df</i> | <i>MS</i> | <i>F</i> | <i>P-value</i> | <i>F crit</i> |
| Between Groups | 162.4867 | 2 | 81.24333 | 0.395758 | 0.676322 | 3.284918 |
| Within Groups | 6774.421 | 33 | 205.2855 | | | |
| Total | 6936.908 | 35 | | | | |

Conclusion:

As the $p > 0.05$, H_0 is accepted and H_a rejected. Therefore there is no significant difference between the green values obtained as drop height is varied.

1.3 Blue Values

H_0 : There is no difference between the blue values obtained as drop height is varied.

H_a : There is a difference between the blue values obtained as drop height is varied.

Dataset Used For Calculation:

| Drop Height | 5 cm | 4 cm | 3cm |
|--------------------|------|-------|------|
| Average Red Values | 32.5 | 29.8 | 30.2 |
| | 31.6 | 37.6 | 36.2 |
| | 14.8 | 22.6 | 16.4 |
| | 36.7 | 41.7 | 37.0 |
| | 0.0 | 0.0 | 0.0 |
| | 32.3 | 43.7 | 40.7 |
| | 0.0 | 0.0 | 0.0 |
| | 27.0 | 23.8 | 21.4 |
| | 33.8 | 42.3 | 39.0 |
| | 30.0 | 40.0 | 25.0 |
| | 18.0 | 103.0 | 15.0 |
| | 82.5 | 90.0 | 80.5 |

Results:

| | | | | | | |
|----------------------------|--------------|------------|----------------|-----------------|----------------|---------------|
| Anova: Single Factor | | | | | | |
| SUMMARY | | | | | | |
| <i>Groups</i> | <i>Count</i> | <i>Sum</i> | <i>Average</i> | <i>Variance</i> | | |
| 5 cm | 12 | 339.2 | 28.26667 | 452.5152 | | |
| 4 cm | 12 | 474.5 | 39.54167 | 942.1227 | | |
| 3 cm | 12 | 341.4 | 28.45 | 464.8464 | | |
| | | | | | | |
| ANOVA | | | | | | |
| <i>Source of Variation</i> | <i>SS</i> | <i>df</i> | <i>MS</i> | <i>F</i> | <i>P-value</i> | <i>F crit</i> |
| Between Groups | 1000.737 | 2 | 500.3686 | 0.80727 | 0.454688 | 3.284918 |
| Within Groups | 20454.33 | 33 | 619.8281 | | | |
| Total | 21455.06 | 35 | | | | |

Conclusion:

As the $p > 0.05$, H_0 is accepted and H_a rejected. Therefore there is no significant difference between the blue values obtained as drop height is varied.