

Appendix B-4

5-Acre Discrete Copper UCL Calculations

General UCL Statistics for Full Data Sets

User Selected Options

From File C:\NewFields Files\NewFields Files\Projects\SFWMD\US Sugar\ProUCL\Citrus_Cu_ByGrove.wst
Full Precision OFF
Confidence Coefficient 95%
Number of Bootstrap Operations 2000

DVQualMergedResult (devils garden)

General Statistics

Number of Valid Samples 357

Number of Unique Samples 167

Raw Statistics

Minimum 8.1
Maximum 139
Mean 27.89
Median 25.4
SD 13.54
Coefficient of Variation 0.486
Skewness 2.091

Log-transformed Statistics

Minimum of Log Data 2.092
Maximum of Log Data 4.934
Mean of log Data 3.224
SD of log Data 0.46

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.0991
Lilliefors Critical Value 0.0469

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.0324
Lilliefors Critical Value 0.0469

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL 29.07
95% UCLs (Adjusted for Skewness)
95% Adjusted-CLT UCL 29.16
95% Modified-t UCL 29.09

Assuming Lognormal Distribution

95% H-UCL 29.15
95% Chebyshev (MVUE) UCL 31.02
97.5% Chebyshev (MVUE) UCL 32.36
99% Chebyshev (MVUE) UCL 35.01

Gamma Distribution Test

k star (bias corrected) 4.905
Theta Star 5.687
nu star 3502
Approximate Chi Square Value (.05) 3365
Adjusted Level of Significance 0.0493
Adjusted Chi Square Value 3365
Anderson-Darling Test Statistic 0.577
Anderson-Darling 5% Critical Value 0.757
Kolmogorov-Smirnov Test Statistic 0.0399
Kolmogorov-Smirnov 5% Critical Value 0.0483

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL 29.02
95% Adjusted Gamma UCL 29.03

Potential UCL to Use

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL 29.07
95% Jackknife UCL 29.07
95% Standard Bootstrap UCL 29.09
95% Bootstrap-t UCL 29.23
95% Hall's Bootstrap UCL 29.18
95% Percentile Bootstrap UCL 29.09
95% BCA Bootstrap UCL 29.13
95% Chebyshev(Mean, Sd) UCL 31.02
97.5% Chebyshev(Mean, Sd) UCL 32.37
99% Chebyshev(Mean, Sd) UCL 35.02

Use 95% Approximate Gamma UCL 29.02¹

General Statistics	
Number of Valid Samples	193
Number of Unique Samples	140
Raw Statistics	Log-transformed Statistics
Minimum	7.3
Maximum	95
Mean	31.82
Median	27.4
SD	16.66
Coefficient of Variation	0.524
Skewness	1.22
Minimum of Log Data	1.988
Maximum of Log Data	4.554
Mean of log Data	3.335
SD of log Data	0.501
Relevant UCL Statistics	
Normal Distribution Test	Lognormal Distribution Test
Lilliefors Test Statistic	0.13
Lilliefors Critical Value	0.0638
Data not Normal at 5% Significance Level	Data appear Lognormal at 5% Significance Level
Assuming Normal Distribution	Assuming Lognormal Distribution
95% Student's-t UCL	33.8
95% UCLs (Adjusted for Skewness)	95% H-UCL 33.97
95% Adjusted-CLT UCL	33.9
95% Modified-t UCL	33.82
95% Chebyshev (MVUE) UCL	37.09
97.5% Chebyshev (MVUE) UCL	39.38
99% Chebyshev (MVUE) UCL	43.87
Gamma Distribution Test	Data Distribution
k star (bias corrected)	4.099
Theta Star	7.762
nu star	1582
Approximate Chi Square Value (.05)	1491
Adjusted Level of Significance	0.0488
Adjusted Chi Square Value	1490
Anderson-Darling Test Statistic	1.669
Anderson-Darling 5% Critical Value	0.756
Kolmogorov-Smirnov Test Statistic	0.0702
Kolmogorov-Smirnov 5% Critical Value	0.0657
Data not Gamma Distributed at 5% Significance Level	Data appear Lognormal at 5% Significance Level
Assuming Gamma Distribution	Nonparametric Statistics
95% Approximate Gamma UCL	33.77
95% Adjusted Gamma UCL	33.78
95% CLT UCL	33.79
95% Jackknife UCL	33.8
95% Standard Bootstrap UCL	33.75
95% Bootstrap-t UCL	33.88
95% Hall's Bootstrap UCL	33.88
95% Percentile Bootstrap UCL	33.9
95% BCA Bootstrap UCL	33.88
95% Chebyshev(Mean, Sd) UCL	37.04
97.5% Chebyshev(Mean, Sd) UCL	39.31
99% Chebyshev(Mean, Sd) UCL	43.75
Potential UCL to Use	Use 95% H-UCL 33.97

Raw Statistics

Minimum 1.2
Maximum 405
Mean 33.9
Median 28.2
SD 24.68
Coefficient of Variation 0.728
Skewness 5.407

Log-transformed Statistics

Minimum of Log Data 0.182
Maximum of Log Data 6.004
Mean of log Data 3.36
SD of log Data 0.562

Relevant UCL Statistics**Normal Distribution Test**

Lilliefors Test Statistic 0.158
Lilliefors Critical Value 0.0247

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL 35.03

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL 35.14
95% Modified-t UCL 35.05

Gamma Distribution Test

k star (bias corrected) 3.213
Theta Star 10.55
nu star 8284

Approximate Chi Square Value (.05) 8073
Adjusted Level of Significance 0.0498
Adjusted Chi Square Value 8073

Anderson-Darling Test Statistic 14.13
Anderson-Darling 5% Critical Value 0.76
Kolmogorov-Smirnov Test Statistic 0.0731
Kolmogorov-Smirnov 5% Critical Value 0.0268

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL 34.78
95% Adjusted Gamma UCL 34.78

Potential UCL to Use

Lognormal Distribution Test

Lilliefors Test Statistic 0.055
Lilliefors Critical Value 0.0247

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL N/A

95% Chebyshev (MVUE) UCL 36.19
97.5% Chebyshev (MVUE) UCL 37.26
99% Chebyshev (MVUE) UCL 39.36

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL 35.03
95% Jackknife UCL 35.03
95% Standard Bootstrap UCL 35.04
95% Bootstrap-t UCL 35.2
95% Hall's Bootstrap UCL 35.26
95% Percentile Bootstrap UCL 35.06
95% BCA Bootstrap UCL 35.07
95% Chebyshev(Mean, Sd) UCL 36.89
97.5% Chebyshev(Mean, Sd) UCL 38.19
99% Chebyshev(Mean, Sd) UCL 40.74

Use 95% Chebyshev (Mean, Sd) UCL 36.89