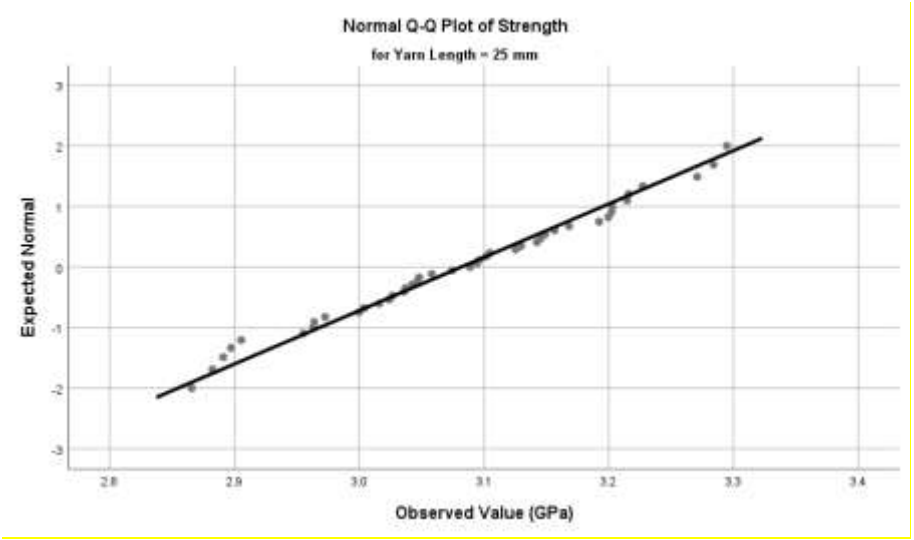
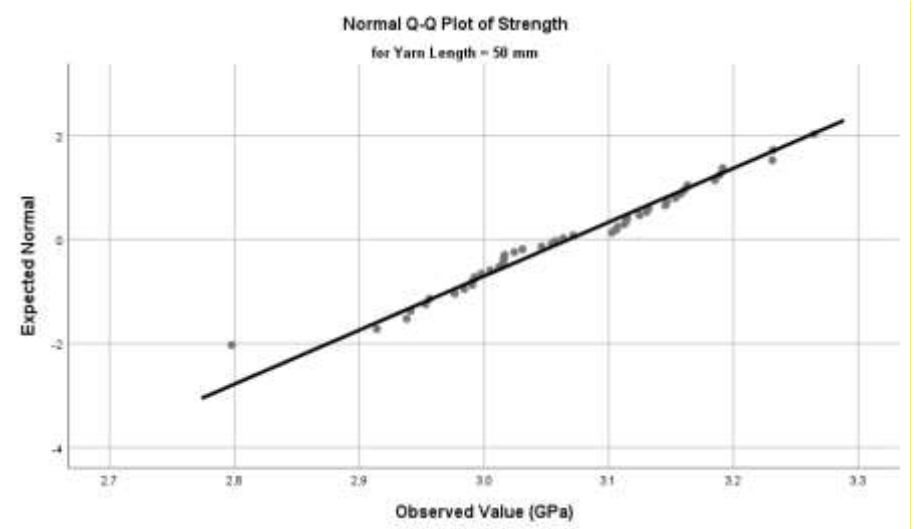
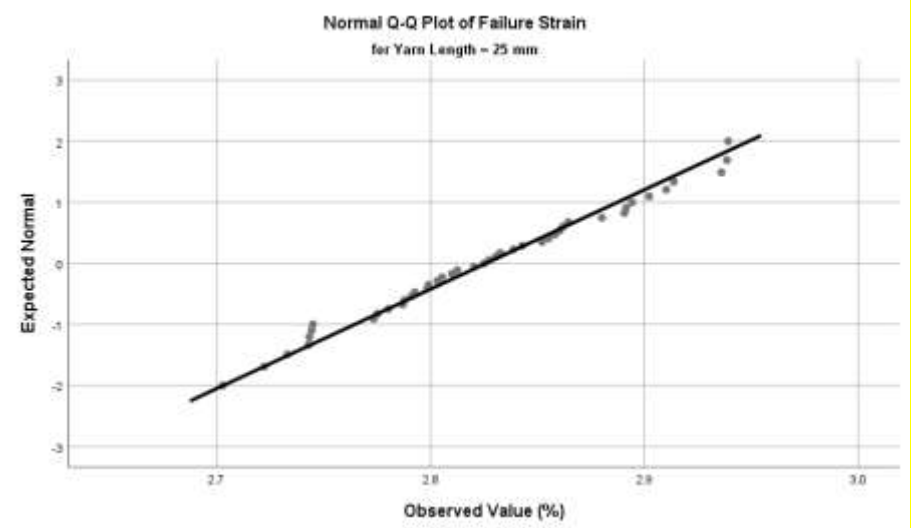
Appendix

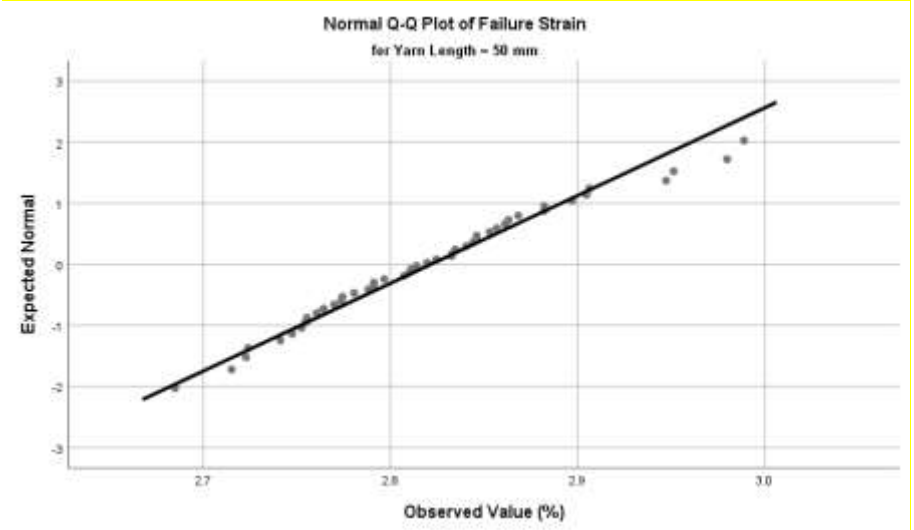
The normal quantile-quantile (Q-Q) plot is an exploratory graphical approach used to check the validity of the assumption that the data set is normally distributed. The basic idea is to compute the theoretically expected value for each data point based on the hypothesised normal distribution. The normal Q-Q plots of different data sets used in the statistical analyses are shown below. The solid line represents a perfect fit to a normal distribution. The normal Q-Q plots allow for easy identification of departures from normality, especially of kurtosis (heavy tails) and skewness in the distribution. Tables 2 and 4 provide the exact statistics for both kurtosis and skewness.

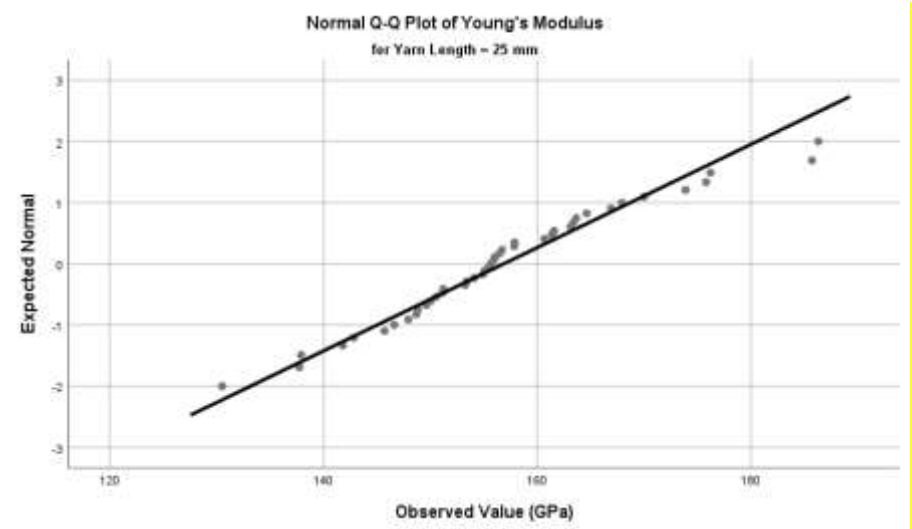
Q-Q plots for gauge length

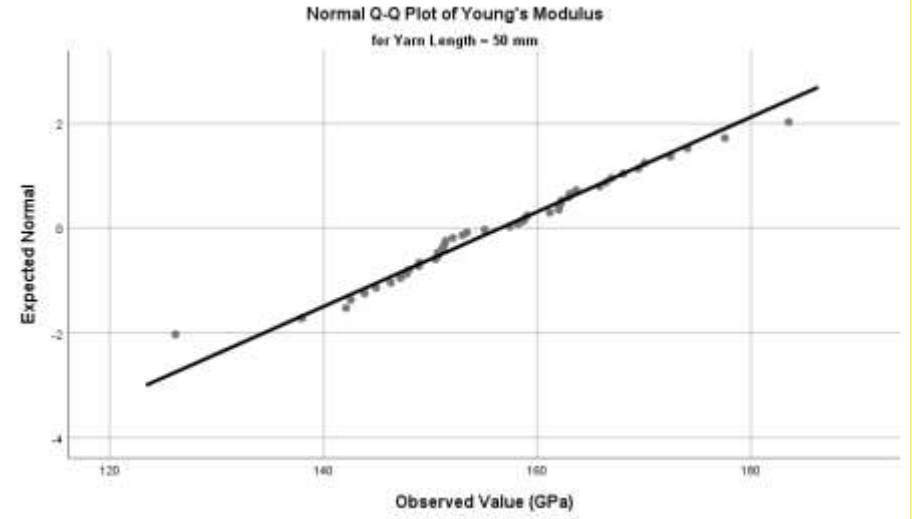


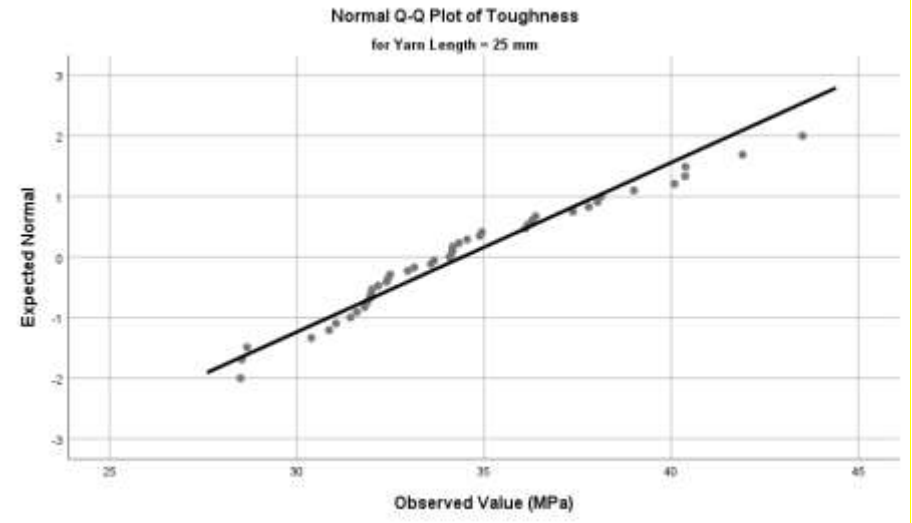

Normal Q-Q Plot of Strength
for Yarn Length = 50 mm
Expected Normal
Observed Value (GPa)

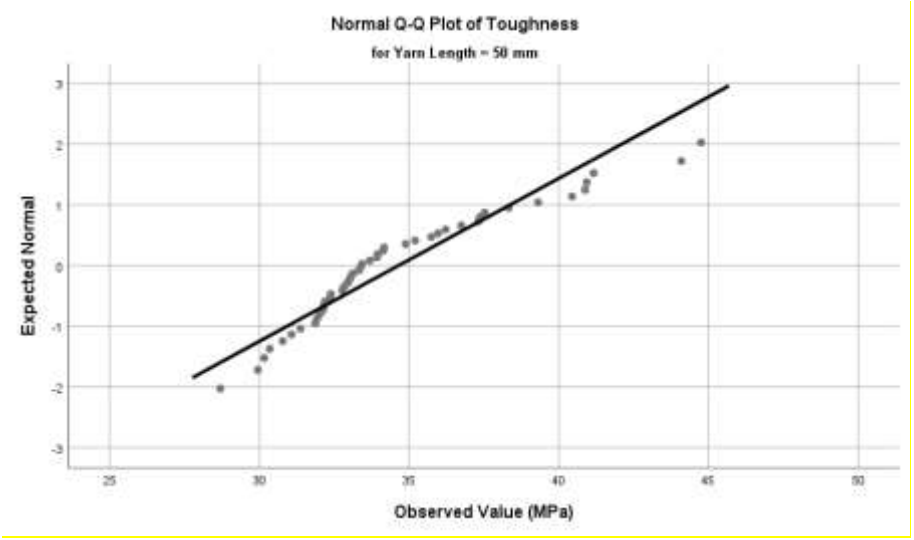

Normal Q-Q Plot of Failure Strain
for Yarn Length = 25 mm
Expected Normal
Observed Value (%)


Normal Q-Q Plot of Failure Strain
for Yarn Length = 50 mm
Expected Normal
Observed Value (%)

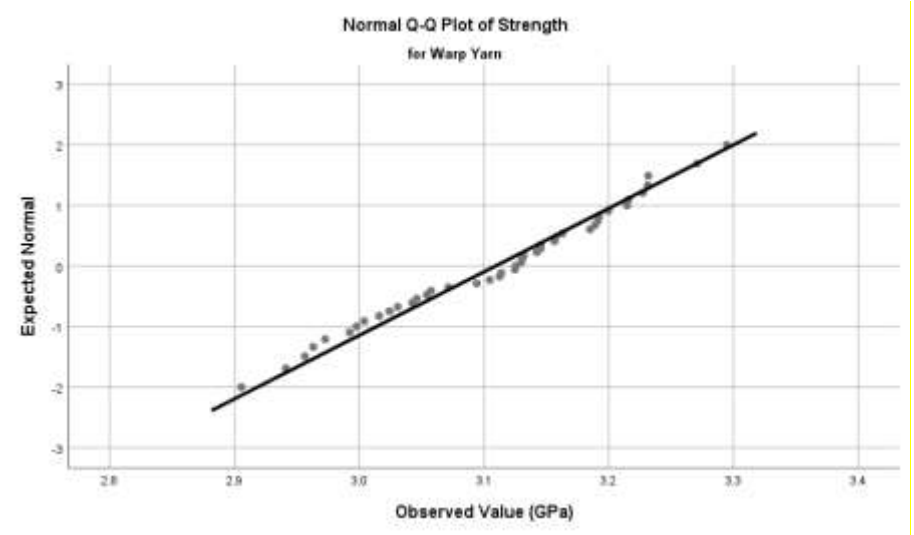

Normal Q-Q Plot of Young's Modulus
for Yarn Length = 25 mm
Expected Normal
Observed Value (GPa)

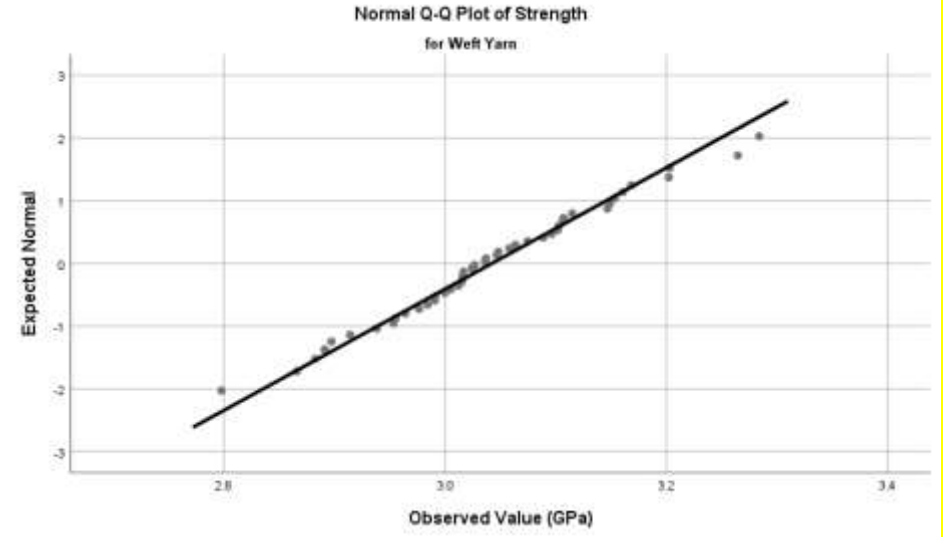

Normal Q-Q Plot of Young's Modulus
for Yarn Length = 50 mm
Expected Normal
Observed Value (GPa)

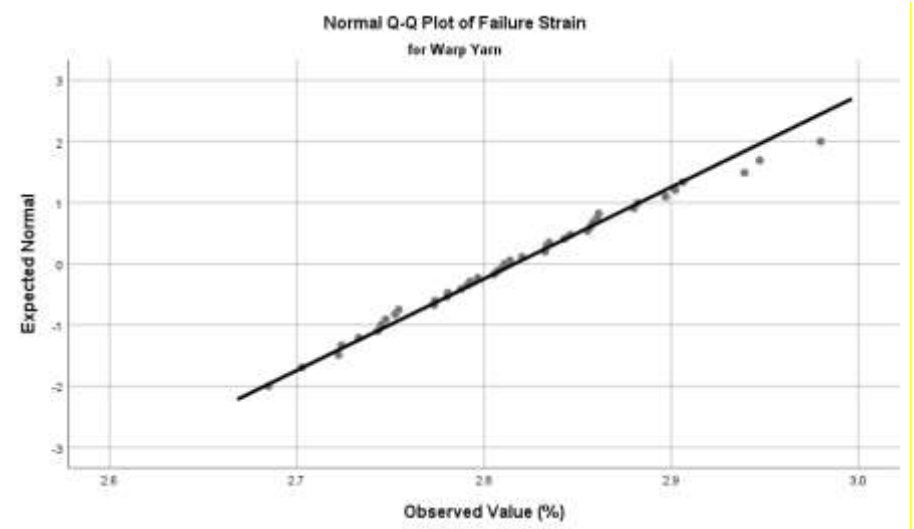

Normal Q-Q Plot of Toughness
for Yarn Length = 25 mm
Expected Normal
Observed Value (MPa)

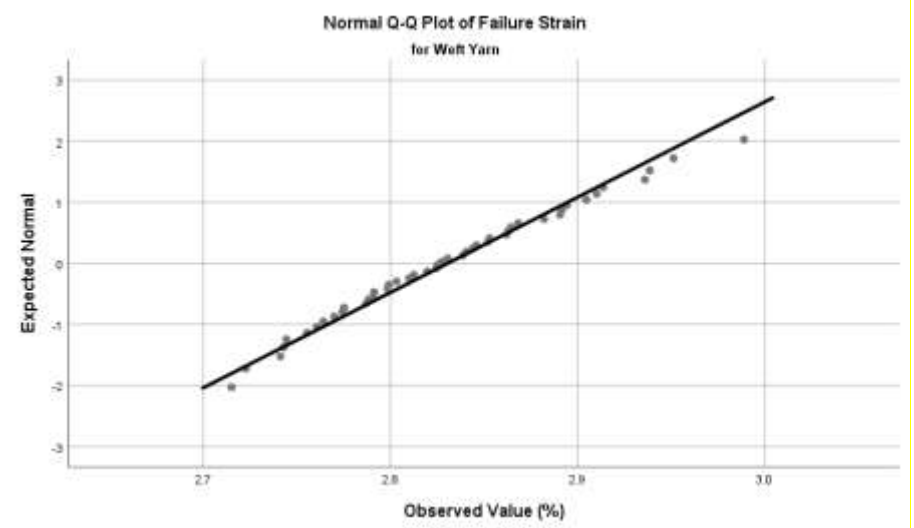


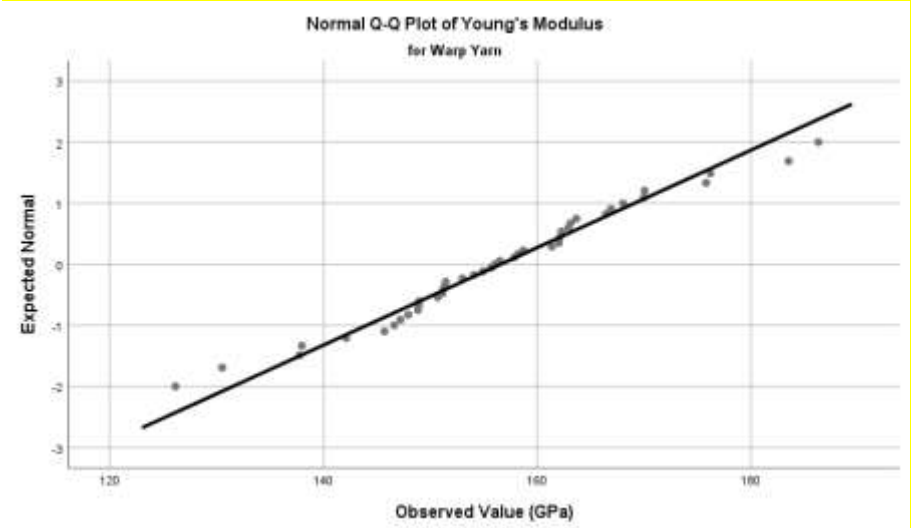
Q-Q plots for yarn type

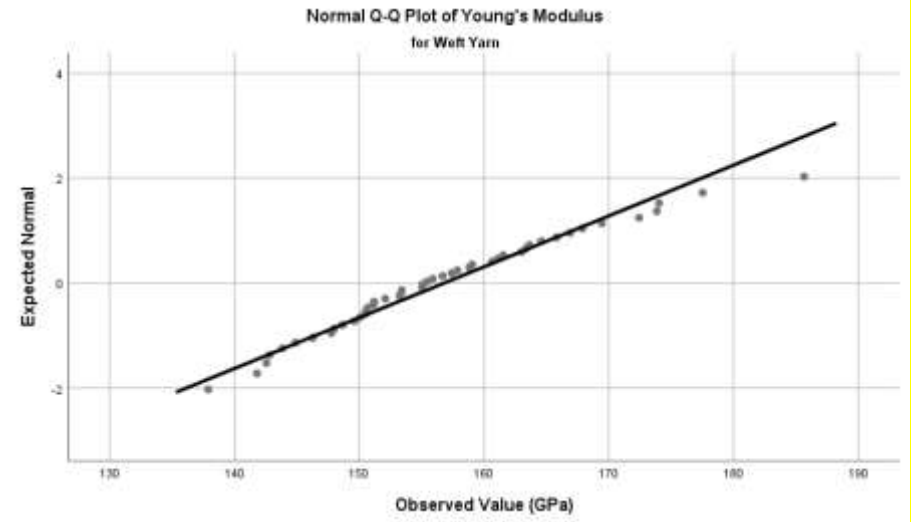


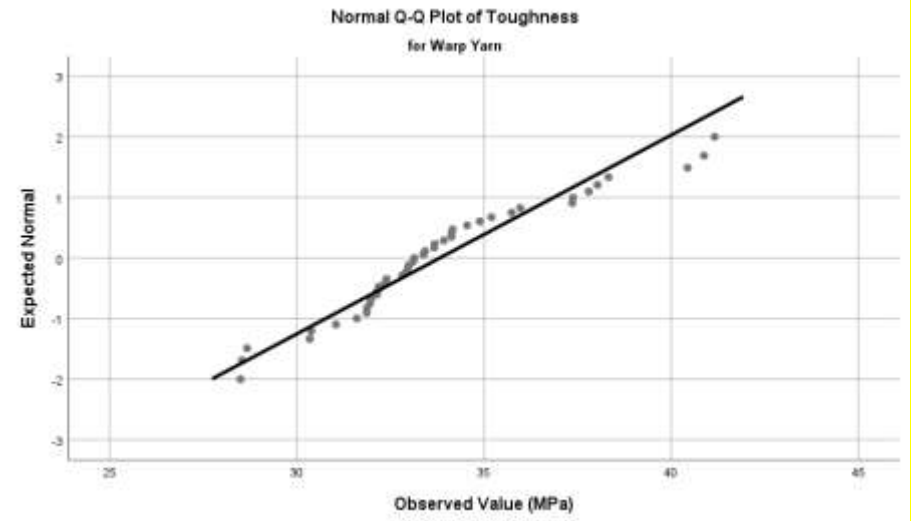


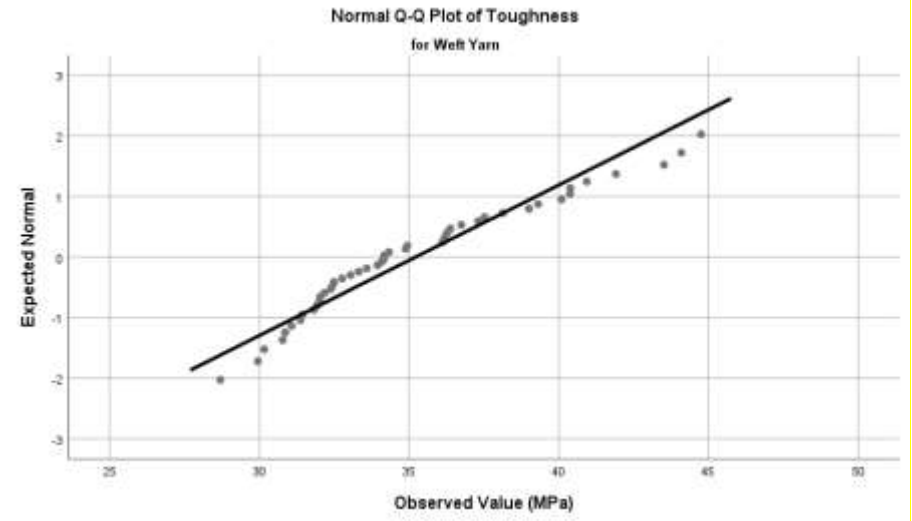

Normal Q-Q Plot of Failure Strain
for Warp Yarn
Expected Normal
Observed Value (%)


Normal Q-Q Plot of Failure Strain
for Weft Yarn
Expected Normal
Observed Value (%)


Normal Q-Q Plot of Young's Modulus
for Warp Yarn
Expected Normal
Observed Value (GPa)


Normal Q-Q Plot of Young's Modulus
for Weft Yarn
Expected Normal
Observed Value (GPa)


Normal Q-Q Plot of Toughness
for Warp Yarn
Expected Normal
Observed Value (MPa)


Normal Q-Q Plot of Toughness
for Weft Yarn
Expected Normal
Observed Value (MPa)