

# A Longitudinal Analysis of the Pattern of Change Over Time for Soybean Yield (1990–2013) By Country

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Figure 1. Soybean Yield (n=797) by Country from 1990–2013.

## METHODS

¾ A sample of 797 records across 34 countries with 24 repeated measurements (1990–2013) of soybean yield (hg/ha) from the Food and Agriculture Organization and World Data Bank were used for this longitudinal analysis.

- The dependent variable, soybean yield (hg/ha), is treated as a continuous variable.
- Countries with multiple (>1) average annual temperatures or countries with <20 occasions were excluded.

### Assessing Pattern of Change Over Time (1990–2013)

¾ A spaghetti plot (Figure 1) showing soybean yield (hg/ha) over time (1990–2013) for 34 countries. The plot shows a general upward trend in yield over time, with some countries showing more rapid increases than others. The variance of the residuals decreases as time progresses, suggesting that the model fit improves over time.

- A Shapiro-Wilk's test indicates normality is not met ( $p < 0.0001$ ). This may be due to deviations in the residual tail ends seen in the QQ plot causing the non-normality. Based on the body of evidence, it appears that normality is reasonably met.

The variances and covariances from the marginal V matrix from the Random Linear model appear to decrease as years pass. There is inherent autocorrelation in that years closer together are more correlated than years farther apart.

¾ Soybean yield increased on average by 133 hg/ha per year (Table 1) from 1990 to 2013. A variance-covariance matrix was estimated.