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**Research Note**

# Significance of Using Soil Depth as a Calibrating Variate in a Fertilizer Experiment on Coconut Yield

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Regression analysis is been freely used in controlling experimental error in an experiment by the choice of some information pertaining to a given experimental material. This is termed as "calibration" by Pearce (1953). The statistical technique used is called "Analysis of Covariance". Use of this technique has been amply demonstrated by Garner *et al.* (1934), Rigney *et al.* (1949), and Sanders (1930).

Field experiments are subject to two main sources of error *viz.* (1) variation due to outside influences such as differences in soil depth, soil fertility, humidity, rainfall, diseases etc. and (2) the inherent variability of the material used. The analysis of covariance has now become well established in agricultural experimentation as an extremely valuable statistical technique in controlling experimental error. The important criteria in selecting a calibrating variate is that (1) it should be related to experimental variate (2) it should not be influenced by the experimental treatments under consideration.

A long term fertilizer experiment (4 x 4 x 4 - NPK) had been carried out at Bandirippuwa estate, Lunuwila, Sri Lanka and yield records for each plot were taken. The blocking for the treatments had been done according to the configuration of the land. However lately it was found that the average soil depth in each of the experimental plot ranged from about 30 cms. to 200 cms. The soil depth for each plot and the average copra yields for the experimental periods 1963-1966, 1967-1970, 1971-1974 and 1975-1978 were used in the statistical analysis. For the purpose of comparison, pre experimental crop data too was used as a calibrating variate, which is a general practice in perennial crops in reducing experimental error.

The following production function was fitted for the yield data of the 4 periods considered.

$$Y = a_1 + a_2 N + a_3 P + a_4 K + a_5 N^2 + a_6 P^2 + a_7 K^2$$

$$+ a_8 NP + a_9 NK + a_{10} PK + a_{11} X$$

Where X is the calibrating variate and other variables having their usual meanings. Table (1) indicates the coefficient of determination ($R^2$) obtained by fitting the above function for the yield data and the calibrating variates.

Table 1. *Coefficient of determination for different calibrating variates*

| *Period* | *Calibrating variate* | *Coefficient of determination ($R^2$ in %)* |
|---|---|---|
| 1963-1966 | a | 28.0 |
| | b | 29.3 |
| | c | 37.1 |
| 1967-1970 | a | 39.7 |
| | b | 41.1 |
| | c | 45.2 |
| 1971-1974 | a | 55.9 |
| | b | 55.9 |
| | c | 66.9 |
| 1975-1978 | a | 65.3 |
| | b | 65.8 |
| | c | 74.8 |

a — No correction
b — Pre experimental data
c — Soil depth

It is evident from the results shown in Table (1) that soil depth could be used more efficiently in controlling the experimental error than the pre experimental yield record. This apparently suggests that in a field experiment on adult coconut palm, soil depth (if soil depth is varying) could become a very valuable calibrating variate and thereby increasing the precision of the experiment.

**Critical soil depth**

For different hypothetical soil depths, correlation coefficients of copra yield vs. soil depth was calculated for the two periods 1971-1974 and 1975-1978. Interesting results thus obtained is worth mentioning here. Table 2 indicates the correlations of copra yield vs soil depth for different hypothetical soil depths.

Table 2. *Correlation coefficient of copra yield vs soil depth for different hypothetical soil depths*

| *Critical depth (cm.)* | *Correlation Coefficient* | |
|---|---|---|
| | 1971-1974 | 1975-1978 |
| 88 | 0.7004*** | 0.6218*** |
| 100 | 0.7338*** | 0.6610*** |
| 113 | 0.7339*** | 0.6812*** |
| 125 | 0.7358*** | 0.6895*** |
| 138 | 0.7066*** | 0.6651*** |
| 150 | 0.6708*** | 0.6564*** |
| 163 | 0.6776*** | 0.6224*** |

*** p = 0.001

All the correlation coefficients (r) in table (2) are highly significant (P=0.001). The value for "r" for each period increases upto 125 cm. and declines thereafter. On the basis of these results it could be reasonable to suggest that the critical soil depth for coconut under Bandirippuwa conditions would be around 125 cm.

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