

THE EFFECT OF THE FERTILIZER ABSENCE IN COCOA DRY BEAN PRODUCTIVITY

Helmi, S.

Malaysian Cocoa Board, Cocoa Research and Development Center Bagan Datuk,
Peti Surat 30, Jalan Sg. Dulang, 36307 Sg. Sumun,
Perak Darul Ridzuan.

Corresponding author: Mohamed.helm@koko.gov.my

Malaysian Cocoa J. 14: 101-103 (2022)

ABSTRACT – *The World Health Organization declared COVID-19 a pandemic since 11th March 2020, many sectors were affected due to this in Malaysia. The upstream cocoa industry is also affected severely. During the pandemic, the delivery of government-subsidized farming inputs to smallholders has disrupted mainly fertilizer. This has caused cocoa growers unable to replenish soil nutrients for optimal cocoa beans production. This study aims to identify the effect of the absence of fertilizer over time and predict the effects of current situations concerning cocoa beans productivity. The study is a review of several fertilizer experiments done by the Malaysian Cocoa Board on different fertilizer applications since 2009. The review analyses the yield of dry bean cocoa on all control treatments of these experiments with the absence of fertilizer. The effect was then analyzed using the stochastic process time series method of analysis. The result of the analysis indicates that, in the absence of fertilizer, cocoa dry bean yield will show decrement after 8 months. And after 16 months yield will significantly drop by 10.37%. A standard single linear regression shows an R^2 of yield and time is low due to stochastic trends. The study concluded that absence of prolonged absence of fertilizer has an adverse effect on cocoa dry bean yield.*

Key words: Fertilizer, cocoa productivity, non-fertilized

INTRODUCTION

The world is facing a pandemic of a deadly infectious disease called coronavirus disease 2019 (COVID-19). To keep the spread and mortality rate under control, Malaysia's Ministry Of Health (MoH) implemented a Movement Control Order (MCO) on March 18, 2020. MCO is the restriction of movement into or out of an area enforced under the Prevention and Control of Infectious Diseases Act 1988 and the Police Act 1967 throughout the country (Bernama, 2020). The sudden enforcement of the MCO by the government put various sectors of the economy in jeopardy. The enforcement of the MCO, lockdown and travel restrictions have significantly disrupted business activities in various sectors, affecting people's income in the country (Shah *et al.*, 2020). One of the affected sectors is logistics and distribution of agriculture inputs (Gray, 2020). Logistics problems had caused government subsidies primarily fertilizer for cocoa growers to be delayed. Although the provisions have resumed, understanding the effect of improper or lack of nutrient supplements on cocoa cultivation affects the productivity of cocoa dry bean yield is crucial.

The most efficient fertilizer application should be applied as close as possible to the time when the plants utilize it. The duration from application and utilization of the nutrients is when nutrient loss often occurs (Beegle, 2002). Fertilizer applications timing is as important as the amount and type of fertilizer applied to produce high yielding cocoa. The application of fertilizers is

necessary for enhancing crop yields and sustaining soil fertility, lack of nutrients in the soil had shown a downward trend in productivity over time (Yadav *et al.*, 2000). For the past 2020, fertilizer supply to cocoa cultivated soils was disrupted mostly, by cocoa smallholder farms. Smallholder farmers make up more than 80% of cocoa dry bean production in the country, a downward trend will also be projected for the cocoa industry. In this paper, understanding the effect of this period of lack of fertilizer applied over an extended-time period affects the cocoa dried yield. This study aims to identify the effect of the absence of fertilizer over time and predict the effects of current situations concerning cocoa beans productivity. The study is also a review of several fertilizer experiments done by the Malaysian Cocoa Board on different fertilizer applications since 2009. The review analyses the yield of dry bean cocoa on all control treatments of these experiments with the absence of fertilizer.

MATERIALS AND METHODS

In agriculture studies, the trend of crop yields is often represented by a straight line suggesting crop yields increase or decrease at a constant rate or trend line. The trend line obtained is assumed that the pattern continues indefinitely and can be used for analysis. Such a model is identified as a 'deterministic trend'. Certain agricultural data can follow a deterministic trend, existing empirical evidence suggests that more complex processes, may be appropriate for cocoa dry bean yields. Cocoa dry bean yields may change due to the influence of location-specific factors such as agricultural

practices, climate, elevations and soil type can also create geographic variation factors impacting yields. Cocoa dry bean yield is a stochastic trend Figure 1, which is an ensemble of random variables indexed by a variable t, which in this study is representing time. The most influencing factors in cocoa yield are the seasonal effect and fruiting cycle.

Deterministic trend (DT):

$$y_t = \beta t + \epsilon_t$$

Stochastic trend (ST):

$$y_t = \beta + y_{t-1} + \epsilon_t$$

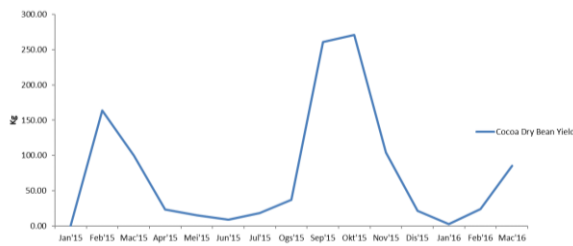


Figure 1: Stochastic trending cocoa yield

The implication of a process of this type of data is that the best prediction of y for the next period is the current value. It can be shown that the mean of a random walk process is constant but the variance is not. Therefore, this process is nonstationary (Qamarul Islam, 2014). Malaysian Cocoa Board has been running fertilizer trials on cocoa dry bean yield productivity. Seven of those experiments were selected consisting of treatments with the absence of fertilizer. The data sets chosen was designated with HyFer Bagan Datuk (Hyfer BD), Hyfer Jengka (Hyfer J), Biojadi Kota Samarahan (Bio KS), Biojadi Bagan Datuk (Bio BD), Biojadi Tawau (Bio T), Biojadi Jengka (Bio J) and Hyfer Sungai Air Tawar (Hyfer SAT). To identify the existence of unit roots, in this study Augmented Dickey-Fuller(ADF) test was applied to the data.

$$\Delta y_t = \alpha_0 + \alpha_2 t + \gamma y_{t-1} + \sum_{s=1}^m \beta_s \Delta y_{t-s} + \epsilon_t,$$

Where yields (Δy_t), the constant term (α_0), Linear trend ($\alpha_2 t$), Lagged Yield (γy_{t-1}) and lagged difference were calculated. The data were then transformed.

RESULTS AND DISCUSSIONS

Data obtained were tested for the existence of unit root using ADF and determining if the trend is stationary or not. Data analysis indicates that only data from Hyfer J, Bio T and Hyfer SAT has calculated statistic values less than the critical values indicating that it has no unit roots hence the data is stationary.

Table 1.0 Test Statistics and Critical Values of the ADF Unit-Root Test.

Experiment	Test statistic	Critical Value (10%)	Hypothesis	Statistic
Hyfer BD	-3.64	-3.10	$\gamma=0$	$\tau\tau$
Hyfer J	1.04	3.66	$\gamma=\alpha_0=0$	ϕ_1
Bio KS	0.52	-1.67	$\gamma=0$	$\tau\tau$
Bio BD	1.23	-2.46	$\gamma=0$	$\tau\mu$
Bio T	2.63	5.24	$\gamma=\alpha_2=0$	ϕ_3
Bio J	2.30	-3.10	$\gamma=0$	$\tau\tau$
Hyfer SAT	5.84	4.34	$\gamma=\alpha_2=0$	ϕ_3

Note: $\gamma=0$ is the null hypothesis of a unit-root and uses $\tau\tau$ statistic, $\gamma=\alpha_2=0$ is the joint hypothesis of a unit-root and a trend and uses ϕ_3 statistic and $\gamma=\alpha_0=0$ is the null hypothesis of a unit root and a constant term and uses ϕ_1 statistic.

For dry bean yield data with the absence of fertilizer will have constant downward pressure on decreasing yield. Determination of the duration of the downward pressure to indicate decreasing in yield, the data were plotted and the trend line was identified in Figure 2. The analysis indicates that without fertilizer, all non-stationary data acquired shows a negative slope. A negative slope implies that the production of cocoa yield is trending down due to nutrient insufficiency. Compared to trials with sufficient fertilizer application, the data indicates an upward trend. The disparity of yield prevails from the 8th month of treatment. And after 16 months yield will significantly drop up to 10.37%.

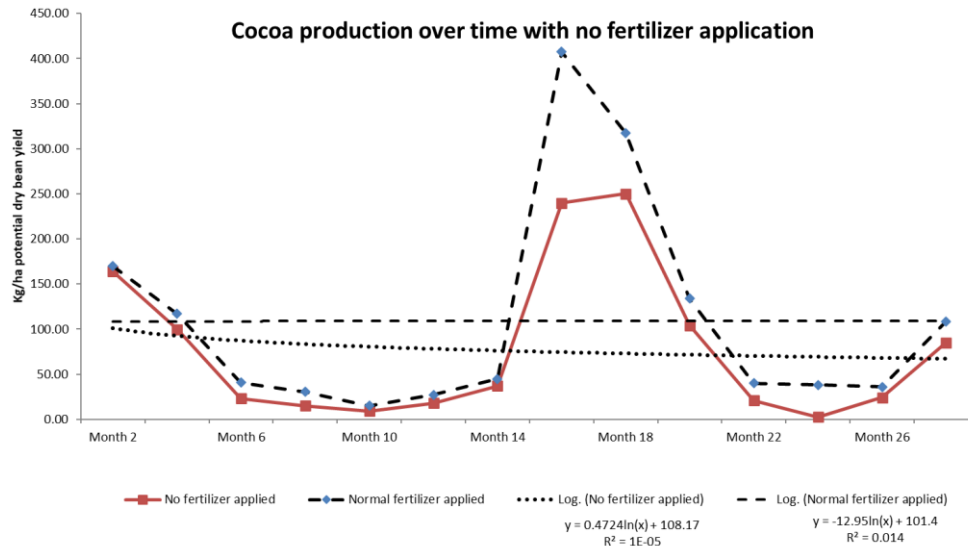


Figure 2: Cocoa production trendline when no fertilizer applied compared to conventional fertilizer application

CONCLUSIONS

The result of the analysis indicates that, in the absence of fertilizer, cocoa dry bean yield will show decrement after 8 months. And after 16 months yield will be significantly reduced. A standard single linear regression shows an R^2 of yield and time is low due to stochastic trends. The study concluded that the prolonged absence of fertilizer has an adverse effect on cocoa dry bean yield.

REFERENCES

- Beegle, D.B. (2002). Soil fertility management. Pp. 18-42. In: E. Martz. (ed.), *Agronomy Guide 2002*. Publications Distributions Center, College of Agricultural Sciences, The Pennsylvania State University, University Park, Pennsylvania.
- Bernama, (2020) Health DG: movement control can boost ministry's fight against Covid-19, The Star Retrieved from <https://www.thestar.com.my/news/nation/2020/03/17/health-dg-movement-control-can-boost-ministry039s-fight-against-covid-19> [Accessed 20 June 2021].
- Gray, R. S. (2020). Agriculture, transportation, and the COVID-19 crisis. *Canadian Journal of Agricultural Economics/Revue Canadienne D'agroeconomie*, **68(2)**: 239–243.
- Qamarul Islam, M. (2014). Estimation in multivariate nonnormal distributions with stochastic variance function. *Journal of Computational and Applied Mathematics*, **255**: 698–714

- Shah, A. U., Safri, S. N., Thevadas, R., Noordin, N. K., Rahman, A. A., Sekawi, Z., Ideris, A., & Sultan, M. T. (2020). Covid-19 outbreak in Malaysia: Actions taken by the Malaysian government. *International Journal of Infectious Diseases*, **97**: 108–116.
- Yadav, R. L., Dwivedi, B. S., Prasad, K., Tomar, O. K., Shurpali, N. J., & Pandey, P. S. (2000). Yield trends, and changes in soil organic-C and available NPK in a long-term rice–wheat system under integrated use of manures and Fertilisers. *Field Crops Research*, **68(3)**: 219–246.