DESIGN TECHNIQUES AND ANALYSIS OF EXPERIMENTS

ON RUBBER (Hevea brasiliensis)

By

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Thesis

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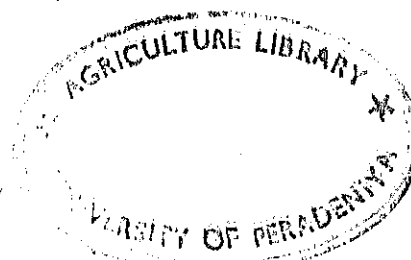

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ABSTRACT

Sound application of statistical methods is essential in planning, implementation, and analysis of experiments to increase precision and better utilization of resources. This study, therefore attempts to further develop some established statistical methodologies and to assess their appropriateness in the analysis of experimental and time series data with special reference to rubber. The study has made emphasis on sampling, control of initial variability, analysis of intercropping trials, application of time series techniques and forecasting approaches.

The possibility of reducing the sampling cost involved in estimation of annual dry rubber yield for field experimentation was investigated using a stratified approach employing four natural strata in the annual yield cycle. A sample size of eight test tappings per year per tree was found to be sufficient with equal allocation in four yield strata. The new system reduces the sampling cost by two thirds when compared to the conventional system.

Control of un-explained variability increases the precision of experiments. Therefore, the possibility of using pre-treatment records of yield, girth and tapping panel variables were investigated in adjusting post-treatment girth and yield. Double covariance was employed to adjust rubber yields using combinations of pre-treatment records. Seed and budded stump weights were used to adjust measurements during the immature stage. Pre-treatment yield is most effective as a covariate in adjusting post-treatment yield during the early years after commencement, but the efficiency declined with time. Pre-treatment girth is more consistent in terms of efficiency with lapse of time.

None of the tapping panel variables showed an improvement over pre-treatment girth. Double covariance did not significantly increase the precision compared to single covariance analysis.

Analysis and interpretation of intercropping experiments are regarded as complex due to inclusion of two or more crops. A single statistical approach is therefore not adequate to address different issues. An attempt was made to quantify the beneficial effects of intercropping related to growth and yield of rubber using available indices and graphical methods with some modifications to suit intercropping systems were adopted.

Time series techniques were applied to study the behaviour of Natural Rubber (NR) prices in Colombo and major overseas markets and to examine the inter-relationships with production, consumption, exports and stocks. The results revealed that the auction prices lead the FOB prices by a period of one month for all grades of NR in the Colombo market. The Colombo FOB prices lag behind the prices of overseas terminal markets by a quarter. The impact of production or exports on price variation was moderate. A similar pattern of seasonal variation was observed for NR consumption and stocks too. The price of NR was not significantly related to consumption or stocks.

The possibility of using Box-Jenkins univariate approach to forecast NR prices in the Colombo market was also investigated. In general, the identified models forecast satisfactorily for all series except for the years where peaks were evident due to structural changes in the NR market.