Spatial-temporal yield trend of oil palm as influenced by nitrogen fertilizer management

ABSTRACT

One of the major challenges in oil palm (Elaeis guineensis Jacq.) plantations today is proper interpretation of yield maps for site-specific management and identification and understanding of the causal factors influencing the variability of oil palm yields. A study was conducted to examine the structural yield variation in order to assess the spatial and temporal yield trends so as to interpret multiyear yield maps of oil palm as influenced by the long-term N fertilizer applications in the palm circlein fertilizer response trial in Sabah, Malaysia. Two clusters of palms were selected for the study; with and without N fertilizer applications for the past 10 years. Fresh fruit bunch (ffb) yields were recorded and summarized on an annual basis. Geostatistical analysis was used to characterize the spatial structure of the semivariogram while point kriging was used to interpolate the ffb yields at unsampled locations. A classified management zone map was developed based on the spatial and temporal stability yield maps from 1992-1999. Semivariance analysis revealed that the yield variations between plots and within plots could be distinguished from the structural semivariogram. The variability between plots was relatively higher compared with within plots. The maximum range of the semivariance of both fertilizer treatments was about 6-palm distance which corresponded well to the experimental plot size of 30 (5¥6) palms. It was also observed that the structure of the semivariogram was governed by the sampling pattern and the experimental plot size. The annual yield maps suggested that the application of N could sustain ffb yields above 30 t ha\-1 year\-1 whereas its removal could result in a drastic decline in ffb yields after 1992. Long-term N fertilizer applications reduced the annual ffb yield fluctuations to between 35 and 45% based on the coefficient of variations between years obtained from individual palms. The results further demonstrate the potential of integrating spatial and temporal stability of ffb yields from multi-year yield data to classify management zones for site-specific oil palm management particularly for fertilizer application. However, the potential of misinterpretation of yield maps can be high if limited data are available. Further work is necessary to ascertain the minimum number of palms and years required for the generation of meaningful yield maps and management zones.

Keyword: Spatial variability; Nitrogen fertilizer; Oil palm yield; Malaysia