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Impact of topography on Oil Palm Yields in Marginal Conditions in Ghana

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Context: Oil palm production in marginal conditions in Ghana and other parts of West Africa

- Ghana's oil palm plantations rest on an undulating relief.
- There is little information on how topographic position impacts on oil palm yields and growth.
- The conditions under which oil palm is cultivated can be considered marginal because of inadequate mean annual rainfall (<2000 mm) coupled with uneven distribution .
- Additionally, there is about 5 months of dry season coinciding with sometimes severe harmattan which invariably lasts for about 3 months.
- Moreover, soils found here are not fertile, especially in replanted areas.
- The soil-relief and pests can also have great impact the yields of oil palm.

Materials and Methods

- Field trial set up in March 2007 consisting of a simple Fisher block design with 4 fertilizer treatments: Very Low Dose (VLD), Low Dose (LD) Moderate Dose (MD) and Standard Dose (SD)
- 6 replicates in total of which 3 replicates are in an upland area (hillside) and 3 replicates are in a lowland area (valley bottom).
- Unit plots of 25 palms of which the innermost 9 were observed.
- Trial established at Okumaning Estate of GOPDC Ltd (Fig. 1) .
- Yield (Fresh Fruit Bunches) records and growth (collar girth and frond length) records from the 4th to the 11th year after planting.

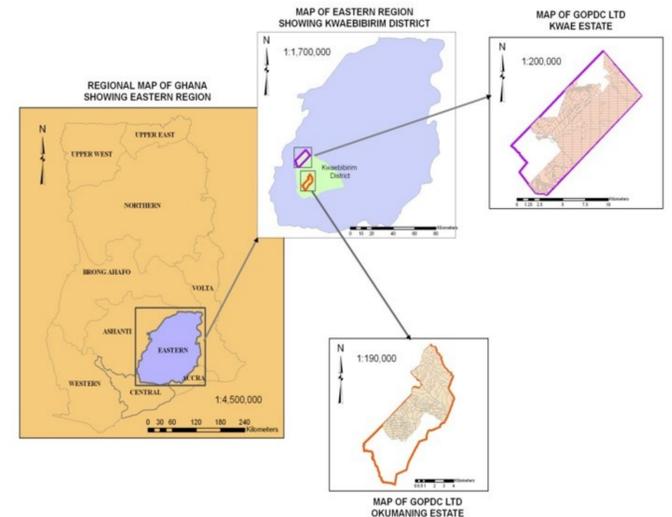


Figure 1: Location of the study area in the Kwaebirem District of the Eastern Region of Ghana

Results

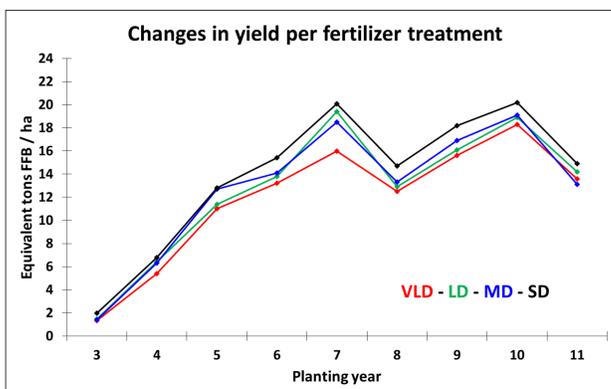


Figure 2: Evolution of the yields for the different fertilizer treatments

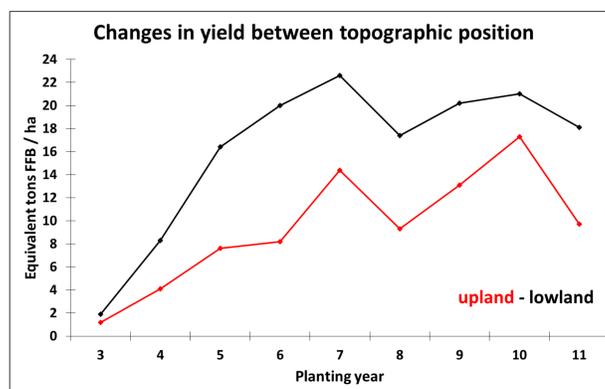


Figure 3: Evolution of the yields for the two topographic positions

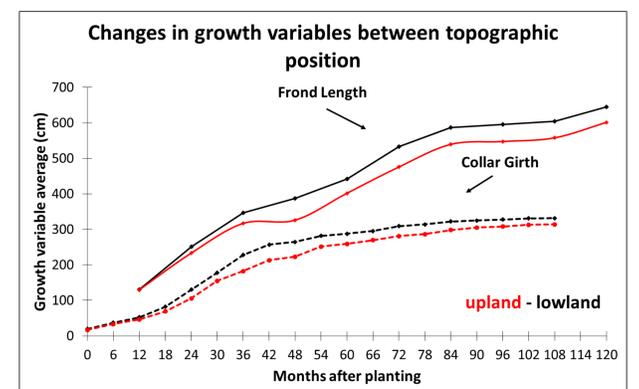


Figure 4: Evolution of 2 growth variables for the two topographic positions

⇒ Fertilizer applications increase yields but only up to a limited extent

⇒ Far greater effect of topographic position on yields with lowlands producing significantly higher yields

⇒ Similar but less pronounced differences in vegetative growth variables between the topographic positions

GOPDC : Proposed land-Use for a better productivity and sustainability

Land Use	Main water collector	Conservation Buffer Area	Oil Palm Plantation	Collection Road	Rubber Plantation	Biodiversity Plot (BDP) Original or reforested Local Forest trees, Mahogany or Teak
Relief	Stream	Swamp—Flat	Valley Bottom (Low Land) Very gentle slope		Hill (Upland) Gentle to Steep slope	Hilltop Slightly bumpy
Soil Series		Oda	Temang	Kokofu	Nzima	Bekwai

Conclusions:

- Relief plays a very critical role on oil palm yields in areas where rainfall is inadequate. Soil moisture deficit, especially during the dry season with the onset of the harmattan, can significantly affect the growth and yields of oil palm
- This effect is more pronounced than the fertilizer applications despite the importance of fertilization for yields and growth
- Oil Palm cultivation should be promoted on the lower slopes and in the valley bottoms, leaving gravelly and stony soils on the hills and hill tops for the planting of forest trees and the less gravelly soils for the cultivation of rubber in order to optimize the use of land under cultivation
- Selection of a suitable soil type such as Temang in the valley bottom ensures that the oil palms are to a large extent protected from the adverse effects of moisture deficit as there is quasi-permanent underground water available to the palms in such soils
- Based on the results from this trial an adapted land use system is proposed for GOPDC that ensures greater productivity and sustainability