Oil Palm (Elaeis guineensis Jacq.) Root System Characteristics in a 12 Year Old Density Trial in Nigeria

Context:
Several plant density trials for oil palm have been set-up and studied across the world over past decades. These usually focus on bunch production and above ground competition for light with occasionally some physiological studies but the root system is usually left understudied.

This paper presents part of the results from a root analysis study carried out on an oil palm density trial in Nigeria. The biomass, root length and density was quantified per palm and per hectare for different soil volumes around the palm trees. This brings further understanding of how planting density affects the underground processes in oil palm plantations under the West-African environment. Characterized by a seasonal soil moisture deficit.

Methodology:
3 different planting densities were studied: 128, 160 and 205 palms/ hectare, corresponding to a spacing of 7.5, 8.5 and 9.5m respectively between the palms.

The simplified voronoi method was used with trenches of 2m deep for 4 palms per density. Volumes were divided based on 4 horizons and 4 zones.

For each soil volume the dry biomass of roots was determined with distinction of primary, secondary and fine roots.

Root samples were scanned and analysed with WinRhizo to determine root length and volume.

Results:

- More root biomass per palm, in lowest density mainly due to more RI production
- More root biomass per hectare for highest density as a result of higher number palms/ha
- Primary roots in low planting densities are more superficial and less branched  
  ⇒ Exploration, less underground competition
- Primary roots in higher densities are relatively deeper and more branches
  ⇒ Exploitation, more underground competition

Conclusion:
- Root biomass per tree and per hectare as well as their distribution differs between the planting densities.
- Branching from primary roots to secondary and fine roots also differ pointing to architectural plasticity of root system that reflects competition for soil resources.

More complementary studies are ongoing to assess the turnover rates of fine roots, the role of soil moisture in root distribution and turnover patterns and the relations between root biomass, total biomass and bunch production.

References: