ABSTRACT

Experiments on cassava root and shoot growth prior to storage root thickening were carried out with different varieties, different planting angles and different nutrient applications in physically favourable medium. Horizontal planting delayed root development compared with vertical and slant planting.

Experiments on growth for 10 days in media with different physical conditions demonstrated marked reduction in root development in media with relatively high penetrometer resistance.

Experiments in the field were carried out with cassava variety TO2/72, planted sequentially on three sites with different soil types, each site having both untilled plots and flat, ploughed-and-rotorvated plots. Harvesting was at 140 and 180 DAP*, corresponding approximately to the end of the wet season and the middle of the dry season respectively. Planting, weeding, fertilizing and insect control operations were done with identical methods and sequence on all sites. Planting sticks were 200 mm long and were planted with vertical orientation. Spacing was 1m x 1m, weeding was done with brush cutlass and paraquat, fertilizer was applied at 24 DAP (40-40-100 kg ha^{-1}) in a hole 0.15m from each stick, and insecticides were used. Each individual treatment was represented by four plots of 15 plants each excluding guard rows.

Weekly measurements were made of soil moisture content and soil penetrometer resistance at several depths using gravimetric and neutron

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* DAP = Days After Planting.

probe, and cone penetrometer methods respectively. Further, these weekly measurements were combined with terminal measurements of soil bulk density and permanent wilting precentage to produce weekly data for air-filled pore space and available water. Amount of root-size soil pores was deduced from terminal pore size distribution measurements.

Results showed that increasing penetrometer resistance at principal rooting depth between $4.0 \times 10^{5} Nm^{-2}$ and $19.4 \times 10^{5} Nm^{-2}$ in presence of both adequate soil air and soil water reduced storage root fresh weight by up to 88 per-cent. Effect of inadequate soil air space interacted with effect of pene-trometer resistance but for both hard and soft soils storage root fresh weight was practically zero below 9 to 10.5 per cent air space.

Cassava crop responded to inadequate levels of soil air space or available water by entering a state of mere survival without growth, and was able to resume growth when conditions became favourable: growth from 0 to 140 DAP on the worst aerated treatment was minimal, but improved rapidly when dry season conditions removed this limitation; growth from 0 to 140 DAP on the most favourable treatment was extremely good, but when soil water became insufficient after 140 DAP leaves were shed, leaf production ceased and storage root fresh weight remained constant.

The most favourable soil physical conditions permitted initiation and development of 16 storage roots per plant (mean number), with 30 to 35 storage roots on several individual plants (Las Lomas tilled). Initiation of storage roots was found to be possible even at the unexpect-edly late stage of 140 to 180 DAP following removal of severe aeration restriction (Las Lomas untilled).

Equations for the dependence of storage root yield on soil physical factors, and equations relating components of crop growth to each other and to soil physical factors were inferred.

The effects of tillage and season on soil physical factors in the three types of soil were evaluated incidentally.