AGRONOMICAL AND PHYSIOLOGICAL FACTORS AFFECTING GROWTH, DEVELOPMENT AND YIELD OF SWEET POTATO IN ETHIOPIA

by

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ABSTRACT

Morphological and anatomical studies demonstrated the root formation characteristics of sweet potato. The presence and importance of preformed root primordia is recorded for the first time. On the vines root primordia are present in sets of four to ten adjacent to the leaf bases. These roots originate from the procambium on both sides of the leaf gap. Macroscopically the root tips of preformed root primordia protruding through the cortex and epidermis of the stems are prominent. The preformed root primordia produce adventitious roots, with pentarch, hexarch or septarch steles. Storage roots will under normal circumstances only originate from undamaged root primordia on the nodes of cuttings, or on nodes of newly formed vines, or from wound roots originating from the cut ends of the stem or leaf cuttings. Lateral roots originating from damaged root primordia, or directly from the adventitious roots, exhibit tetrarch steles and develop into fibrous roots without the potential to develop into storage roots. This understanding of the origin, anatomy and morphology of sweet potato roots should improve production practices, which will contribute to improved crop establishment and increased yield.

Differences in the contribution of individual subterranean nodes to storage root yield were studied. On average cuttings with three subterranean nodes produced 3.7 storage roots, with 33.2% on subterranean node 1, 30.0% on node 2 and 36.8% on node3. However, in terms of fresh mass of the storage roots node 1 contributed 45.4%, node 2 contributed 27.1% and node 3 contributed 27.4%.

The effect of temperature (20, 24, 28 and 32 ^{o}C constant), orientation of cuttings (vertical vs. horizontal) and size of cuttings (1 or 3 nodes) on the development of adventitious roots was observed in plant growth chambers. Twenty-one days after planting, the longest total root length of 4m per plant was recorded from the 24 ^{o} C growth chamber. The effect of soil moisture content on early root development was investigated by wetting and equilibrating sandy soil to 100, 80, 60 and 40% of field capacity. Although the 80% of field capacity treatment resulted in the best root development, differences among treatments were small, demonstrating the capacity of cuttings to successfully establish under a range of soil moisture contents.

Changes in dry mass of storage roots, stems, and leaves of three sweet potato cultivars (Awasa-83, Bareda and Falaha) were studied at Awasa and Melkassa. At the final sampling the early maturing cultivar Falaha had diverted a higher proportion of the total dry mass into

storage roots at Melkassa because of the early initiation and growth of storage roots. The late maturing cultivar Awasa-83 had a smaller proportion of the total dry mass diverted into the storage roots at both locations because of late root initiation and growth. The high yielding cultivars Bareda at Melkassa, and Awasa-83 at Awasa, had higher crop growth rates and higher net assimilation rates than the other cultivars.

The effects of cultivar (Kudadie, Bareda and Awasa-83), planting position (horizontal and vertical), type of planting material (terminal cuttings with and without leaves) and cutting length (20, 25 and 30 cm) on the number and yield of storage roots were quantified in field trials at Awasa and Melkassa. Cultivar Kudadie produced the highest storage root yield at both locations. Horizontal planting of cuttings resulted in the highest total storage root yield at both locations. Cutting length did not affect storage root number and yield.

The effect of population density (50,000, 55,555, 75,000, and 100,000 cuttings per hectare) on the performance of the three Ethiopian sweet potato cultivars was studied at Awasa. The highest planting density consistently produced the best root yield, indicating the potential to increase yields with plant populations much higher than normally used. Early maturing cultivar Falaha produced more small and medium storage roots per plant, while the intermediate cultivar Bareda produced more large storage roots.

Key words: Adventitious root, cutting characteristics, dry matter partitioning, *Ipomoea batatas*, leaf gap, planting density, preformed root primordia, soil moisture, subterranean node, sweet potato, wound roots.

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