EFFECTS OF COMBINED NUTRIENT AND WATER STRESS ON THE GROWTH OF *HOPEA ODORATA* ROXB. AND *MIMUSOPS ELENGI* LINN. SEEDLINGS

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Abstract. The growth of *Hopea odorata* and *Mimusops elengi* seedlings under drought and various fertilization rates under nursery conditions was investigated. Both *H. odorata* and *M. elengi* seedlings responded differently to fertilizer application and drought. Application of slow-release fertilizer (Best Tab, 20:10: 5 NPK) at 30 and 50 g promoted greater height growth for *H. odorata* and *M. elengi*-seedlings, respectively. *M. elengi* seedlings were able to tolerate high fertilizer application (50 g), but the resulting form (small trunk diameter and excessive height) was not suitable for urban planting. Growth of *H. odorata* seedlings was greatly promoted through application of 30 g of fertilizer under well-watered conditions, resulting in a much more balanced growth in terms of shoot and root ratio, which is vital for plants growing in the harsh urban environment where competition for water and nutrients is usually intense.

Key Words. *Hopea odorata*; *Mimusops elengi*; urban environment; drought; fertilization; plant growth.

Soil conditions and tree nutrition are limiting factors to tree growth in urban areas. Urban sites are often subjected to soil removal or disturbance during road construction, resulting in loss of organic matter and nutrients (Craul 1992). Plant moisture and the onset of plant water stress caused by soil water deficits are generally recognized as the principal limiting factors controlling the growth of urban trees (Kozlowski 1986; Clark and Kjelgren 1990; Day 1994; Tognetti et al. 1995). Apart from drought, plants are subjected to soil compaction, a serious problem in urban areas (Craul 1992). Thus, urban soil conditions can be difficult for root growth (Watson 1998) because nutrients are often limiting under conditions of soil compaction and water stress. Plant growth is often retarded because the ability of plant roots to absorb maximum nutrients is impaired.

The impact of drought on ornamental plants is most serious after the plants are transplanted in the landscape (Craul 1992). Urban soils have poor chemical quality and lack capacity to retain water. An evaluation of water economy of street trees in New York City, U.S., found that tree water deficits occurred less frequently than presumed and that water deficits were more closely linked to high evaporative demand than to limited soil moisture (Whitlow et al. 1992). Therefore, additional information on the water required by trees to remain healthy, particularly information linked to aerial and an edaphic planting site characteristic, is needed.

This study was undertaken to determine the growth performance of *Hopea odorata* and *Mimusops elengi* seedlings under drought conditions and various fertilization rates during nursery production and determine whether drought reduces the negative impact over fertilization on seedlings.

MATERIALS AND METHODS

Potting Medium and Seedlings

A Tropeptic haplorthox soil series was used in the experiment, and the soil was mixed thoroughly in an automated mixer. It was later sieved to remove stones and other unwanted materials before filling 4 kg into polythene pots measuring 30 cm height and 24 cm diameter with a volume of 452 cm^3 of soil. The seeds of *Hopea odorata* and *Mimusops elengi* were collected from the Forest Research Institute Malaysia (FRIM) and the Universiti Putra Malaysia arboreta. The seeds were germinated in a sand bed. After germination, the seedlings were transplanted into polythene bags with a potting mixture of 7:3:2 soil, sand, and peat. Uniform seedlings (in terms of height) were selected and transplanted one to a pot. At the age of 6 months old, seedlings of both species were used for the experiment at different periods, *H. odorata* first, then 3 months later *M. elengi*.

Experimental Design and Treatments

The experiment was a 6 × 2 factorial design arranged in randomized complete block with each treatment replicated six times, for a total of 288 polybags. Tables 1 and 2 give the treatment combinations and the levels of various nutrients present in the treatment combinations. Slow-release fertilizer (Best Tab, 20:10: 5 NPK) was applied once at the beginning of the experiment and was placed 10 cm below the surface in tablet form (NPK 20-10-5). The watering treatments were (1) no stress (seedlings were kept well watered at field capacity ≥ – 0.3 MPa); and (2) water stress (water was withheld until the soil water potential was ≥ –1.5 MPa and then rewatered to field capacity).