THE IMPACT OF SOWING MEDIUM AND NITROGEN FERTILIZATION RATES ON PRODUCTION AND GROWTH OF MAHOGANY SEEDLINGS

By

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B.Sc. Agric. Sci. (Soil Science), Fac. Agric., Ain Shams Univ., 1987

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ABSTRACT

Mona Salah Mahmoud Ahmed. The impact of sowing medium and nitrogen fertilization rates on production and growth of mahogany seedlings. Unpublished M.Sc. Thesis, Arid Land Agricultural Graduate Studies and Research Institute, Faculty of Agriculture, Ain Shams University, 2017.

This study was carried out at the nursery of Horticulture Department , Faculty of Agriculture , Ain Shames University during two seasons of 2015 and 2016 to study the effect of sowing medium and fertilization rates on vegetative growth and chemical composition of *Swietenia macrophylla* and *Khaya senegalensis* seedlings. Three different sowing media were used i.e., S M_1 = Perlite : peat moss: compost(1:1:1) , SM_2 = perlite : peat moss : compost(1:2:1) and SM_3 = Perlite : peat moss : compost (1:1:2) (v/v). Also ,four fertilization rates were used as follow : without fertilizer (control),5,10 and 15 g / plant of **hydrocomplex** fertilizer .The following data were recorded, stem height (cm),stem diameter (mm) , leaves number/ plant, leaf area (cm2) and total fresh and dry biomass (gm). Moreover, chlorophyll a & b leaves contents (mg/g FW.), total carbohydrate content (mg/g DW), nitrogen, phosphorus and potassium content in leaves (% D.W.) were determined. Regarding the effect of sowing medium, the obtained results showed that, using sowing medium which content the highest percentage of compost (1:1:2) significantly increased plant height, stem diameter, leaves number/ plant, leaf area, total fresh and dry biomass ,total carbohydrate content and potassium leaves content in comparison the other growing medium whereas, differences were insignificant in chlorophyll a & b, nitrogen and phosphorus leaves content. concerning the effect of fertilization rates, using fertilization at the rate of 15 g / plant caused significantly increased plant height, stem diameter , leaves number / plant, leaf area, total fresh and dry biomass, chlorophyll a & b content, total carbohydrate content, nitrogen, phosphorus and potassium leaves

content in comparison the other fertilization rates with the exception of leaf area, chlorophyll a , phosphorus and potassium leaves content at the rate of 10g / plant in the second seasons only. As for the interaction between sowing medium and fertilization rates, In general, application of growing medium which contain a high ratio of compost (1:1:2) was superior in all tested characteristics followed by which contain a high ratio of peat moss (1:2:1) at 15 gm fertilization as compared to the other treatments.

Keywords: Mahogany, Swietenia, macrophylla, Khaya, senegalensis, Fertilization, Sowing, Medium, Seedlings.

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INTRODUCTION

Trees have several helpful effectiveness; using wood for structure, biofuel, pulp industry, water conservation, fodder, some of oil types … etc. On other hand, tree plantations used for controlling both of water erosion and wind speed and achieving the shade target and refuge. Also, Trees play an important role in preventing the collapse of slopes in addition to establishment of dams. Trees plantation led to reduce soil temperatures and enhancing of organic matter accumulation and delayed soil hardening **(OTA, 1982 ; Rosewell, 1993 and Marcar *et al.,* 1995).**

Trees have a useful role in replenishing nutrients to crops and contributing the ameliorate in the soil conditions. Trees accumulate both of nutrients and organic matter within their ecosystems by capturing atmospherical depositions, biogeochemical cycling and biological fixation. One of the important sources for the soil organic matter is trees and forests **(Johnson *et al.,* 1998; Mafongoya *et al.,*1998; Hunter, 2001; Young, 2002; Deans *et al.*, 2003; Semwal *et al.,* 2003 Harmand *et al.*, 2004; Bot and Benites, 2005 and Berg and Mc-Claugherty, 2008).** By means of the biogeochemical mechanism, trees are able to cycle and storage large quantities of nutrients in their biomass and the solum. The most dynamic part of the tree biomass is the litter constituted mainly from dead foliage and roots, and which is turned-over annually (**Smailla *et al.*, 2011; Carnol and Bazgir 2013; Kiser *et al.,* 2013; Xiaogai*et al.,* 2013 and Daldoum and Ghassan, 2014).**

The environmental and economic important of associated trees are rarely evaluated. Trees plantation outside the forests may be useful in soil fertility maintenance, landscaping, tenure issues, and multi-porpouse (medicines, fuel wood, fodder, food, timber, etc.) but it is obviously not totally used **(Depommier, 2003)**. With increasing of human populations and apprehension regarding the sustainability of different forms of land use increase, a large degree of attention is being given to evaluate both

the benefits and costs of introduced species **(Pysek and Richardson, 2010)**.

Trees play an important role in soil conservation by improving soil structure, increasing soil organic matter, reducing soil erosion and assisting in nutrient cycling. Rehabilitation of degraded land can be a step by trees plantations. Trees enable monitoring landscape processes, but they do this on long-term of time than crops and pasturage. Trees recycle nutrients through taking them above from bottom and stored them on the soil surface as litter, which then resolving to form organic matter of soil.

Growing media and fertilization are important factors in containerized seedling production systems. In developing countries, seedlings are often produced in polybags filled with mixtures of locally available materials. Seedling growth and quality is affected by the type and amount of these substrates used in the mixture. Differences in seedling growth and quality can also be significantly affected when fertilization is employed during the nursery growing period **(Shalizi, 2015)**.

The growing media ingredients which used in filling container of nurseries. Improving of seedlings morphological characteristics and increasing its quality in a short time were affected by using an appropriate growing medium than seedlings production methods. Vermiculite, Peat moss and Perlite have instead of compost, sand and soil in nurseries containerized in much of developed countries. Because these materials are porous and light, so, it increase root growth in containers, and makes it easy to elevate and transport seedlings for planting. In some countries, application of vermiculite, peat moss, and Perlite as growing media are very high costly and, in most case, typically not affordable. In addition that, there are locally sourced available substance such as rice straw, compost, wheat straw , sawdust, and mulch that can be inserted with sand and soil inside the growing media. For example, in some countries, inorganic materials were used in growing media with organic

materials. Perlite, vermiculite, pumice and sand are some example of inorganic materials and coir pith, sugar cane waste, sawdust, tree bark, water weeds, wheat straw and rice hulls are example of organic materials both of two material produced composted **(Mohanan and Sharma, 2005)**.These materials can be inorganic or organic, but growing media are predominating formulated from a mixing of various materials or components with a view to achieve the proper balance of air availability and water holding capacity in order to the growth well of plants. In addition, composted materials have been routinely used as a components of growing media or growing medium **(Bilderback *et al.,* 2005; Schroeder and Sell, 2009 and Nair *et al.,* 2011)**.

The soil media have various serious functions in relation to growth of plant. Nursery seedlings quality is influenced by potting media (**Agbo and Omaliko, 2006**) they provides moorage for the plant's roots; air spaces to allow respiration; and it acts as a plant backing, serves as a provenance of water and main plant nutrients and allow the diffusion of oxygen to roots to satisfy these essential plant requirements **(James and Michael, 2009)**.The main factors in evaluating programmers of tree planting are quality of growth media which used to raise containerized seedlings efficiency **(Manenoei *et al.*, 2009)**. It is considered a source of nutrients as well as acts a growing media for plant (**Bhardwaj, 2014**).

Enhancing the efficiency fertilization of nursery soils is necessary for warranty of high quality seedlings production for nursery establishing **(Rafiqul *et al.,* 2004)**. A healthful seedling must be well provide with all the nutrients in the suitable Proportions for efficient growth **(Craven *et al.,* 2006 and Gbadamosi, 2006)**. Species differ in nutrient requirements and the necessity for a particular element or nutrient count on the growth requirements of the species. Nutrient requirements for different species in the nursery also vary with environmental conditions **(Pinkard *et al.,* 2006)**. For improving plant productivity and vigor, application of fertilization is widely used in nurseries **(Shen *et al.,* 2010)** Moreover,

application of fertilization led to improve plant growth by either increasing soil resources or by modifying soil pH **(Jose *et al.,* 2003)** or by increasing the ability of seedlings to garner resources **(Lincoln *et al.,* 2007)**. Because of this, plants increase their rate of photosynthesis, basal area, volume, stem diameter and stem height, (**King *et al.,* 2006).**

At the nursery growing period, seedling growth, development and quality of seedlings can be increasing by using fertilization and controlling of time, amount and types of fertilization **(Duryea and Landis, 1984)**. In addition, **(Chamshama and Hall, 1987)** showed that, the seedlings of *Eucalyptus camaldulensis* had a higher survival rates with increasing the rates of potassium (K) fertilization while, with enhancing nitrogen (N) fertilizer rates , seedlings produced maximum numbers of first order lateral roots, greatest shoot growth, and conserve high N concentrations in the leaves. Besides, using high levels of nutrients can also reducing root growth and lowering survival on drier sites **(Harvey and Driessche, 1997)**. **Luis *et al.,* (2009)** investigated the impact of fertilization on *Pinus canariensis* seedlings**.** The seedlings which fertilized at the nursery had 90% survival, while in non-fertilized seedlings survival declined to 60% . **Oliet *et al.,* (2009)** mention that fertilization influenced nutrient storage and seedlings morphology and enhanced resistance to the conditions of drought. Moreover, nursery fertilization had more effective in increasing survival rates the seedlings of *P. halepensis* on the planting site. Forest tree seedlings, like other plants, require both of macro and micro nutrients with a view to grow and survive. N, P and K are three distinguished macro elements that are indispensable in the first stage of seedling development. Appropriate availability of N in leaves is essential for photosynthesis that eventually promotes shoot and root development **(Oliet *et al.,* 2009)**. On other hand, **(Stahl *et al., 2013)*** studied the impact of added phosphorus (P) on early development of *E. dunnii* and *E. benthamii* seedlings. Both species showed a great response of growth by increasing of P supply, which caused enhanced in total dry mass.