

Prospect of Neem Plantation at Arafat, Saudi Arabia

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ABSTRACT

Neem (*Azadirachta indica*A.Juss.) is a multipurpose agroforestry tree that is well adapted to a wide range of climatic and soil conditions and has gained worldwide recognition for its pharmaceutical and pesticidal properties. The world's largest pure Neem plantations are available in the plains of Arafat, Saudi Arabia where 50,000 thousands Neem trees were planted to provide shade from the blazing summer sun for the millions of Hajis (Muslim pilgrims). Sporadic mature Neem trees are also found in Medinah, Taif and else where of the Kingdom. The Neem tree is adapted to Arafat under harsh climatic conditions of Saudi Arabia and the plantation may be extended to other parts of the Kingdom as a avenue tree and also to minimize the desertification under changing climatic conditions and to improve the environmental condition of the country. At Arafat mixed plantations may be advocated to save the present plantation which may come from climate change as well as pest and diseases problems. So care must be taken to monitor the diseases of Neem tree at Arafat on a regular basis. Because of insufficient growth of Neem at Arafat the methods of green cultivation with microbial inoculants, organic fertilizers, mycotrophic green manure plants may be practiced for successful plantation.

Key words: Neem, Pest, Disease, Distribution, Green cultivation, Saudi Arabia.

INTRODUCTION

Neem (*Azadirachta indica*A.Juss.) tree is very important culturally, medicinally and pesticidally and has gained worldwide recognition for its pharmaceutical and pesticide properties. The Neem tree is a fast growing plant that belongs to mahogany family (Meliaceae) and can reach a height of 15–20 metres, rarely to 35–40 metres. It is evergreen, but in severe drought it may shed most or nearly all of its leaves. The branches are wide and spreading. The fairly dense crown is roundish and may reach a diameter of 15–20 metres in old, free-standing specimens. It will grow in low rainfall areas and it thrives in areas of extreme heat and arid conditions. It is estimated that a Neem tree has a productive life span of 150 - 200 years. Because of multifarious use and medicinal properties as well as environmental importance, the United Nations has declared the Neem tree as "Tree of the 21st century "(UNEP 2012) and The US National

Academy of Science mentioned the tree as "Neem: A tree for solving global problems" (NAS 1992). Africa considers Neem as a green gold. In Senegal, Neem tree is known as the "Independence Tree" (ABC 2013). So there is a urgent need to assess the prospect of Neem cultivation and to study the growth requirements for green cultivation of Neem at Arafat, Kingdom of Saudi Arabia (KSA). The present paper is a part of our ongoing research programme in the Department of Plant Production , King Saud University on green cultivation of neem at Arafat, under the supervision and guidance of the authors of the present paper. The paper deals with the prospect of Neem cultivation at Arafat, Makkah, KSA.

Importance of Neem

Neem as an important multipurpose agroforestry tree is adapted to a wide range of soil conditions and has been extensively documented and reviewed (Duke and du Cellier, 1993; NRC

1992; Tewari 1992). In the Indian subcontinent, the Neem tree has been used for more than 4500 years. In the last two decades, research on Neem has been intensified and many of the agricultural and medical properties of Neem were rediscovered (Botelho *et al.* 2008; Drabu *et al.* 2012). Neem is an omnipotent tree and a sacred gift of nature (Upma *et al.* 2011). It is a divine tree mainly cultivated in Indian subcontinent and has been used extensively by humankind to treat various ailments from prehistory to contemporary (Kumar and Navaratnam 2013). All parts of this tree are commonly used in traditional Indian medicine for treating various human diseases (Botelho *et al.* 2008; Drabu *et al.* 2012). The earliest documentation of Neem mentioned the fruit, seeds, oil, leaves, roots and bark for their advantageous medicinal properties (Kumar and Navaratnam 2013). The Neem tree also provides clean air to the atmosphere.

Worldwide distribution of Neem

Neem tree is native to Pakistan, India, Bangladesh and Myanmar and is now widely grown in almost all African countries as well as in arid and semi-arid areas of the world. It is now widely cultivated in Mauritania, Senegal, The Gambia, Guinea, Ivory Coast, Ghana, Burkina Faso, Mali, Benin, Niger, Nigeria, Togo, Cameroon, Chad, Ethiopia, Sudan, Somalia, Kenya, Tanzania, and Mozambique (Infonet-Biovision 2013). The Neem tree was introduced in places such as Australia, East and sub-Saharan Africa, South East Asia, and South America. Today, the Neem is well established in at least 30 countries worldwide, in Asia, Africa and Central and South America. Some small scale plantations are also reportedly successful in Europe and United States of America (see Kumar and Navaratnam 2013). Neem trees were also introduced in Pan ZhiHua, Sichuan province, China (Zhang *et al.* 2007). There are over 400000 Neem trees in Yunnan province that make Yunnan the biggest artificial area of Neem planting globally and the material center of Neem products in China. Chinese Academy of Forestry played an important role in methods of cultivation of Neem (YGNIDC 2013). In West Africa (Somalia to Mauritania), it is a leading candidate for helping halt the southward spread of the Sahara Desert. In the last decade, Neem has been introduced into the Caribbean

Islands, where it is Neem is already a major tree species in Haiti (Lewis and Elvin-Lewis 1983).

Distribution of Neem in Saudi Arabia

The world's largest Neem plantations are available in 10 sq km areas in the plains of Arafat, Saudi Arabia (Saleem *et al.* 1989). The plantation of fifty thousand Neem trees was initiated on the plains of Arafat near Makkah by a Saudi philanthropist. Khattab and El-Hadidi (1971) reported from the results of a botanical expedition to Saudi Arabia in 1944-45 that mature Neem trees were found in a garden west of Medinah. Now-a-day's mature (appx. 50-60 years old) Neem trees are found in many houses in Jeddah. In Makkah one tree was found which is more than 100 years old. Many mature Neem trees are found also in Medinah, Taif and elsewhere (Saleem *et al.* 1989). Neem trees are for landscaping in Saudi Arabia and are found as common avenue trees in Jeddah.

Climatic conditions, soil and water management

Neem is an important multipurpose tree species that has been observed to be well suited to all kinds of lands and wide range of environment (Tewari 1992), especially tolerant to poor soils of arid and semi-arid regions (Benge 1989). The plant is generally well adapted to the frost-free, warm and tropical dry conditions of Asia (Duke and duCellier 1993; NRC 1992; Tewari 1992). Usually the vegetative growth is rapid in tropical areas of higher precipitation (Ahmed 1995). Neem plantation is available in sub-humid to semi-arid and arid climatic conditions. It can grow in areas with mean annual temperatures of 21 to 32°C and can survive as high as up to 50°C temperatures, but does not tolerate frost or extended cold. The Neem tree grows in areas with mean annual rainfalls of 450 mm to 1,200 mm. It can grow in regions with an annual rainfall below 400 mm, but in such cases it depends largely on the ground water levels and also frequent irrigation. Neem grows in areas from sea level (altitude), however it thrives at low altitudes also. The tree grows on a variety of soils, clayey or sandy, saline or alkaline, but will not grow in waterlogged soils. It can thrive on dry, stony, shallow soils and even on soils with hard calcareous or clay pans at a shallow depth, its roots can access ground water within 9–12 m of the ground surface (Stoney 1997). Once established it is drought tolerant and can

survive 7–8 month dry seasons. Neem can grow in soils with a wide pH range. The optimum growth is at pH 6.2 to 7, but it can also grow well down to pH 5 and survive in soils between pH 3-8.5 (Infonet-Biovision 2013). The Neem tree is being cultivated at the plains of Arafat because the tree can withstand the harsh climatic conditions of Saudi Arabia, where sometimes the temperatures go up to 50°C and annual rainfall drops as low as 30-40 mm. Neem is one of a very few shade-giving trees that thrive in drought-prone areas and under Saudi conditions the plants get frequent irrigation during summer season.

Propagation and planting

Seed production of Neem is often low in high rainfall areas. The viability of Neem seeds is very short, less than three months. The best way to propagate the Neem tree is through seeds. The seeds may be placed in moist chamber. After a week the seed will crack and sprout ready to be planted in compost made of half soil and half cow dung manure. To propagate from a cutting, a small twig has to be stripped of its leaves and stuck into moist soil. In Bangladesh, Mridha *et al.* (2002) used effective microorganisms for growth on neem under nursery condition and found improved growth.

Pests and Diseases of Neem

Neem trees are suffering from different types of foliar and root diseases caused by different types of biotic (fungi, bacteria, virus etc.) and abiotic (drought, salinity, temperatures, humidity, pH etc.) factors like other plants. Our general view is that since the plants are being used against different diseases caused by biotic factors, why they would suffer from different diseases. But reality is that Neem trees are also getting infected and some are facing heavy losses. By and large, most Neem trees are reputed to be remarkably pest free; however, some pests and diseases occasionally attack Neem trees.

The following insect pests are recorded from Neem tree: *Aonidiella orientalis* Pinnaspis-strachani; *Phyllocoptes* sp.; *Tetranychidae* (Spider mites); *Heliothrips hemorrhoidalis* (Bche) *Thysanoptera thrips*; *Scirtothrips aurantii* (Faure); *Heteropsyllacubana* Crawf (*Leuceanaps*

yllid); *Ceroplastes floridensis* Comst (*Homoptera-coccidae*) (NRC 1992; Infonet-Biovision 2013).

Despite the fact that the leaves contain fungicidal and antibacterial ingredients, certain microbes may attack different parts of the tree, including the following: *Cercospora subsessilis*; *Fusarium* sp., *Colletotrichum gloeosporioides*; *Alternaria alternata*; *Rhizoctonia solani*; *Oidium azadirachtae*; *Corticium salmonicolor*; *Ganoderma lucidum*; *Diaporthe* sp etc (Infonet-Biovision 2013; Tewari 1992). Sinniah *et al.* (1983). Studied on seed mycoflora of Neem during storage found highly contaminated by fungi mostly *Aspergillus* spp. Recently, Mehrotra and Pandey (1991) described leaf spotting and blight of Neem caused by *Colletotrichum gloeosporioides* and *Alternaria alternata*. They have also recorded poor germination of seeds due to *Fusarium* species. In an ongoing research programme at Chittagong University, Bangladesh (headed by the first author of the present paper), we have recorded several foliage diseases of Neem. They are *Pseudocercospora* leaf spot (*Pseudocercospora* (*Cercospora*) *subsessilis* (Mridha *et al.* 2001); *Colletotrichum* Leaf spot (*Colletotrichum gloeosporioides*); *Alternaria* leaf



Fig. 1: A diseased neem plant at Arafat, Makkah

spot and blight (*Alternaria* sp); powdery mildew (*Oidiumazadirachtae*) (Mridha *et al.* 2005) etc.

DISCUSSION

During our recent visit to Arafat to observe the present conditions of Neem plantations, we have encountered that large number of plants are dying (Fig. 1). The reasons may be physiological and/or pathological. And also the plant growth was not very luxurious. It was also observed that new plantations are going on. The Neem trees are found on the road side of Makkah city near Arafat and also plants are found to be unhealthy. All parts of this very useful tree are extensively used by humankind to treat various ailments from prehistory to contemporary. So extending Neemplantation in KSA, the plant parts may be used in Saudi Arabia as herbal medicine to treat common diseases.

High quality seedlings are essential to develop good quality plantations. The quality seedlings may be raised under nursery conditions by inoculating microbial inoculants for rapid growth in the nursery and for survival of seedlings after plantation. This is because, microbial inoculants like Arbuscular mycorrhizal fungi are an imperative component of soil microbial biomass influencing essential processes at the plant-soil interface. It has been observed that roots of Neem are profusely colonized by AMF and it is considered as a highly mycorrhizal dependent tree species (Habe *et al.* 1993). In our recent observation (manuscript under preparation), we have recorded high infection of mycorrhizal fungi in the Neem roots collected from Arafat and also isolated different types of *Glomus* spp. from the rhizosphere soils of Neem trees.

The soils and climatic conditions for the growth of Neem must be considered before raising any plantation in KSA. The draught and salinity is a major problem in growing plants under Saudi

conditions. To overcome these problems, urgent research is needed to understand how to alleviate the draught and salinity for growth of Neem at Arafat and other parts of the country. As the water is very important under Saudi conditions, so research may be designed for proper usages of water for irrigation during summer months. Requirement of nutrient and judicious application of nutrient is to be determined under plantation after assessing soil nutrient status at Arafat.

The pure plantation is not always desirable for successful plantation of tree species in any particular areas and is sometimes harmful from ecological, environmental and microbiological point of view. In Arafat mixed plantations may be advocated to avoid the disastrous outcome from climate change as well as pest and diseases problems.

Finally non chemical approaches that means the way of green cultivation with microbial inoculants particularly inoculation of Arbuscular mycorrhizal fungi under nursery conditions to raised mycotrophic seedlings for plantation in the field and also improve the growth, draught tolerance and alleviation of salinity under field conditions, addition of organic fertilizers under field conditions to the soil physical and chemical properties and mycotrophic green manure plants (both legumes and non legumes) for life mulch and supply of green manure as well as essential nutrients through microbial activities and plant residues may be practiced for successful plantation of Neem not only at Arafat but also throughout the Kingdom.

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