الإصدار الخامس - العدد تسعة وأربعون
تاريخ الإصدار: 2 – تشرين الثاني – 2022م
www.ajsp.net
ISSN: 2663-5798

“The Moringa Tree and its Many Uses, especially in the Agricultural Field”

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Agricultural Engineering Degree: Master's degree in vegetable production

AJSP
المجلة العربية للنشر العلمي
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Abstract:

Moringa is one of the most useful tropical trees. It's known as the “Horseradish tree” or the “Drumstick tree”. Many research reports show that due to its multipurpose uses; the Moringa tree has recently grown attention in several countries. The Miracle tree is a nickname given to the Moringa tree because all its parts are used for nutritional, medicinal, and agricultural uses. Moringa has naturally occurring plant growth stimulants in its leaves like zeatin which belongs to the cytokinin group. The foliar application of moringa leaf extract stimulates plant growth and yield by effective mechanisms. In Jordan Moringa peregrina was founded as a wild plant called “al Ban “or “Al Yussr”. The objective of this research was to overview the nutritional, medicinal, and agricultural implications of the Moringa tree.

Keywords: Moringa, Moringacea, Oleifera, peregrine, Medicinal use, Nutrient content.

Introduction:

The Moringaceae family is a tropical flowering plant family, it has a genus known as moringa, and it contains 13 diverse species from tropical and subtropical climates that range in size from tiny herbs to massive trees (Shahzad et al., 2013). Moringa oleifera and peregrine are the most common and utilized moringa species (Lalas et al., 2012). In English M. oleifera is commonly known as the Horseradish tree, Drumstick tree, Never Die tree, and West Indian Ben tree (Ramachandran et al., 1980). Also, it is a short, slender, deciduous, perennial tree about 10m tall with drooping branches, brittle stems, and branches, feathery pale green 30-60 cm long compound leaves, creamy white flowers, pendulous triangular pods (Foidl et al., 2001). Moringa peregrina tree grown like a wild plant in the Arabian Desert known as drumstick tree, it has a wide geographic range, growing from the Dead Sea area sporadically along the Red Sea to northern Somalia and around the Arabian Peninsula to the Arabian Gulf (Boulos, 1999). Also, it is a deciduous tree, 6-10 m tall, with large leaves and thin pendulous branches. M. peregrine shows a xerophytic modification in its leaves and stems following water deficit treatment. These modifications include reducing surface to volume ratio of leaf and stem, leaf rolling and hair covering, and increased frequencies and indexes of stomata as found by Al-Gohary and Hajar (1996). Also, M. peregrina can tolerate harsh conditions and it is considered a donor to transfer stress tolerance gene to other economical plants to increase their drought tolerance as reported by El-Lamey, (2015). Although Jordan is a small country with restricted water and land resources, it is characterized by a large variation in wild plants. M. peregrina occurs naturally in lower Jordan Valley, Dead Sea area, Wadi Araba, Wadi Feynan, and Hamamat Afra in the Tafila area, Alhasa Valley, Wadi Alyarmok, and Alhameh / Irbid which is locally called Al- Ban or Al Yussr (Ministry of Agriculture, Frosty Department.2009; Tellawi, 2006). The objective of this study was to overview the nutritional, medicinal, and agricultural implications of the moringa tree.

Description of Moringa oleifera

Moringa oleifera is commonly referred to as the 'drumstick tree'. Other common names are horseradish tree, bene he oil tree, or benzoyl tree. Some parts of the Moringa tree (leaves, pods, seeds, flowers, fruits, roots) are ingested for food, and some for medicinal purposes. Moringa oleifera is a fast-growing deciduous tree. Its maximum height is 10-12 m, and the trunk diameter can reach 45 cm. Flowers are about 1.0-1.5 cm long and about 2.0 cm wide. Flowering begins within the first six months after planting. The fruit is a drooping, three-sided brown capsule, 20–45 cm in size, containing dark brown spherical seeds about 1 cm in diameter. On the seeds, he has three thin, whitish wings that allow water and wind to smoothly disperse the seeds. The tree also requires an annual rainfall of 250mm to 3000mm and can survive in temperatures between 25°C and 40°C, making it suitable for tropical climates. Moringa trees grow mainly in semi-arid tropical and subtropical regions. Moringa is commonly grown or cultivated in various countries in Central America, the Caribbean, northern South America, Africa, Southeast Asia, and Oceania. Of the 12 species in the genus Moringa, the most commonly cultivated and widespread is Moringa oleifera, native to the sub-Himalaya regions of India and Pakistan.

ISSN: 2663-5798

Uses of Moringa in Soil and Plants

The Moringa tree is one of the most nutritious plants in the world. It has many uses for plants and soil, such as green manure and natural growth promoter. Whether extracted from water or ethanol, MLE has high antioxidant activity and is rich in plant secondary metabolites such as ascorbic acid and total phenols, making it a potential natural growth stimulant. , exogenous application of MLE improves productivity in many crops. Several studies have focused on the role of his MLE in promoting plant growth and increasing the production of numerous crops. Furthermore, like other bio stimulants, MLEs are used to improve plant tolerance to abiotic stress.

Moringa is a plant that grows in drought conditions and in all soil types. The use of Moringa sprouts as green manure can greatly enrich agricultural soil. In this method, the soil is first plowed and then Moringa seeds are planted 10 x 10 cm at a depth of 2 cm. Plant at intervals (density of 1 million seeds per hectare). Plow the seedlings into the ground to a depth of 15 cm, after which the soil is prepared for the intended culture. Aqueous extracts from fresh Moringa leaves are rich in antioxidants, secondary metabolites, and osmoprotectants. In addition, MLE contains vitamins, zeatin, indole-3-acetic acid (IAA), cytokinins, gibberellins (GA), and several minerals (e.g., P, Ca, K, Mg, Fe, Cu, Zn, and minerals). . The variety of ingredients contained in MLE suggests that this aqueous extract can be effectively used as a herbal biostimulant, making it one of the most natural growth stimulants available. This tree also contains many healing properties and chemicals for other purposes and is sometimes called the "miracle tree". These advantages are related to the geographical distribution of these trees. They are of particular value because they are found in areas with high population densities and high levels of poverty. Among some uses of moringa is the aqueous extract of leaves as a hormone booster in many crops. Therefore, as a growth promoter, MLE could be a natural and practical alternative to synthetic sources used to improve crop productivity. In addition, both plants and soil benefit from the effective benefits derived from the content of many bioactive ingredients.

Uses of Moringa in the Animal and Poultry Industry

Almost all parts of Moringa oleifera are used as food. M. oleifera leaves are used as food and animal feed during dry and drought seasons. Moringa pods, flowers, roots, and leaves are cooked and eaten in place of green vegetables in Africa and Asia. The high protein content, excellent mineral profile and presence of vitamins (particularly A, B, and C) in moringa leaves make them fodder for livestock and poultry. Contains 30-40% essential oil (Ben Oil). Ben oil provides adequate levels of oleic acid, sterols, and tocopherols to help prevent rancidity, and has antiviral, antioxidant, anti-inflammatory, cardioprotective, anti-asthmatic, and anti-cancer benefits. The antibiotic and antifungal effects against solani, Bacillus subtilis, Staphylococcus aureus, and Pseudomonas aeruginosa are attributed to pterygoid spermine contained in moringa seeds. Anemia patients are treated with the leaves to increase iron levels, and the roots and bark are used to treat heart disease. The efficacy of animal feed concentrates can be improved by supplementing with M. Oleifera leaves. Reported that soybean meal (SBM) supplemented with moringa leaves significantly affected the growth performance (body weight and weight gain) of poultry. The birds were also in good health and had good feed conversion ratios (FCRs). MLE has antiviral effects against the Newcastle disease virus (NDV). Applying Moringa oleifera to animals and poultry has great benefits, but overuse in large quantities can lead to negative consequences.

AGROECOSYSTEM ADAPTATION AND DISTRIBUTION

Moringa Oleifera Rum. It is believed to be native to Agra and Oud in northwestern India, south of the Himalayas (Fig. 1). It is now grown in all tropical countries (Fig. 2). Moringa is classified as a tropical plant, but is adapted to a wide range of agroclimatic conditions. Moringa can grow and remain productive in subtropical and semi-temperate climates where temperatures remain below freezing or above 0°C from early spring through late fall. In these areas, warmer seasons result in higher growth rates and higher biomass yields, but pod development and seed production may be limited.

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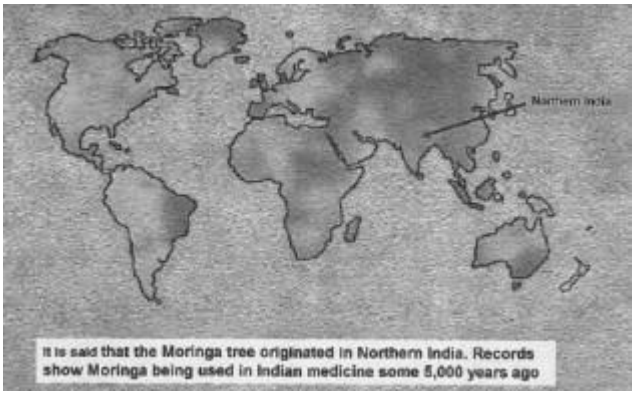

Figure 1. Map showing origin of Moringa oleifera

Figure 2. Geographical distribution and adaptation (green shaded) of Moringa oleifera in the tropics

CLIMATE AND SOIL PREFERENCES

Moringa is most commonly cultivated in tropical or subtropical semi-arid regions. It grows best at temperatures between 25 and 35°C, but will tolerate up to 48°C in the shade and can survive a light frost. For example, in subtropical USA (20-30°N latitude), moringa grows well, and once the root system is well established it overwinters and regrows the following spring. Growth is slowed down by temperatures below 10°C. Moringa is drought-tolerant and grows well in areas receiving annual rainfall amounts that range from 250 to 1500 mm. It can also tolerate high rainfall in excess of 2000 mm, but most cultivars are sensitive to flooding and waterlogged conditions (Palada et al., 2012). Altitudes below 600 m are best for moringa, but it can also grow in altitudes up to 1200 m in the tropics.

Moringa can be grown in a variety of soil types and conditions from well-drained sandy loam soils to heavier clay loam soils; however, it prefers a well-drained sandy loam or loam soil. It will not survive under prolonged flooding and poor drainage (Palada and Chang, 2003; Prabhakar et al., 2003). Moringa tolerates a wide range of soil pH (5-9), growing quite well in alkaline conditions up to pH 9 (Palada, 1996; Palada and Chang, 2003; Prabhakar et al., 2003; Price, 2007).

According to Olson (2017), the key factors that determine and influence the growth and cultivation of moringa are a) temperature, b) moisture (rainfall), c) latitude, and d) elevation. Tables 1 and 2 summarize the temperature and rainfall ranges and combinations for optimum growth of moringa. These illustrate the point that M. oleifera prefers warm climates with warmer temperatures. The highs can be high, but the lows need to be high. Rainfall tends to be low, 1500 mm or often much less, and is highly seasonal, usually with eight months or so of very dry weather. Moringa is a lowland plant, growing best below 500 m a.s.l.

ISSN: 2663-5798

Food uses and nutritional value

Moringa is one of the most useful tropical trees. All parts of it are edible and have long been utilized for different purposes, but leaves are commonly the most used (Popoola and Obembe, 2013; Sivasankari et al., 2014). Moringa leaves are highly nutritious with an abundant amount of protein, minerals, beta-carotene, and antioxidant compound. Also, they have more calcium than milk, more vitamin C than oranges and more protein than milk and eggs as well as more potassium than bananas (Leone et al., 2015). In addition, moringa was found to have a group of compounds containing sugar and rhamnose, which are uncommon sugar-modified glucosinolates (Fahey, 2005). Moringa leaves are eaten as a salad, and vegetable soup for human nutrition (Popoola and Obembe, 2013). Also, seeds of M. peregrine are of economic and nutritional importance; the extracted seed oil is used by Bedouins in cooking (Hegazy et al., 2008). In Ghana and some parts of Asia particularly India and Bangladesh M. oleifera was used as a nutritional supplement and remained popular among the lower socio-economic class (Anhwange et al., 2004). The seed oil is highly rich in fatty acids like olive oil and was utilized as a good substitute (Lalas and Tsakinis, 2002).

Medicinal Uses

Moringa species are one of the most powerful trees in tropical and subtropical areas of Asia and Africa, it is considered rich with different medicinal values that used in treating several diseases like hysteria, abdominal tumors, prostate troubles and skin infections (Rahman et al., 2009). Moringa and its healing potential were documented for the first time around 5000 years ago in the Vedic literature in India (Patwardhan, 2000). In folk medicine, M. peregrina leaf extract is rubbed over skin to treat paralysis and skin rashes (Ghazanfar and Al-Al-Sabahi, 1993). The pod oil is used to treat the convulsions or infantile paralysis in the northern region of Oman (Miller and Morris, 1988). Its seeds are most commonly used to control diabetes in Sultanate of Oman (Al-Qahtani, 1995; Reddy et al., 2015). Also, moringa leaves are used to elicit lactation and boost the immune system (Anwar et al., 2007; Popoola and Obembe, 2013; Sivasankari et al., 2014). In addition, moringa flowers act as anti-arthritic; hypocholesterolemic agents can cure urinary and cold problems (Fuglie 2005).

Moringa as a forage plant

In addition to the use of moringa in the field of food and health, it is also used as animal fodder (Sanchez et al., 2006; Nouman et al., 2012). The nutritional characteristics of the Moringa tree are excellent so it can easily be used as fresh forage material for cattle. The leaves are rich in protein, carotene, iron, and ascorbic acid and the pod is rich in the amino acid lysine (Chawla et al., 1998; Dogra et al., 1975). Another important advantageous characteristic of moringa is its high productivity of fresh material per unit area compared with other forage crops.

Water purifications

Using chemicals for water purification can cause serious health hazards if an error occurs in their administration during the treatment process as shown by Crapper et al., (1973). The use of Moringa has an added advantage over the chemical treatment of water because it is biological and has been reported as edible.

Agricultural uses

Moringa seeds contain high levels of proteins and make a good fertilizer for use in agriculture as reported by Fuglie (1999). Moringa leaves act as a source of plant growth factors, antioxidants and vitamin C Makkar et al. (2007). In addition, the extract obtained from the leaves of moringa in 80% ethanol contains growth enhancing principle called zeatin (El Awady, 2003). Moringa leaf extract contains proteins, amino acids, ascorbic acid, phenolic compounds, sugars, and minerals (i.e. calcium, magnesium, sodium, iron, phosphorus, and potassium); hence, it is used as a natural plant growth enhancer (Anwar et al., 2007). The present knowledge ascertained that moringa leaves, seeds, and pods contain appreciable amounts of specific plant pigments with demonstrated potent antioxidant properties such as the carotenoids (lutein, alpha-carotene, beta-carotene, and xanthin) and chlorophyll (Owusu, 2008). It was also shown that M. peregrina has a high mineral content mainly Mg element which was observed in the leaves this is a very essential element as the main component of chlorophyll compound and has a significant role in photosynthesis (Al Rawashdeh et al., 2016).

The foliar application of moringa leaf extract stimulate earlier cytokinin formation thus preventing premature leaf senescence and resulting in more leaf area with higher photosynthetic pigments (Hanaa et al., 2008; Rehman and Basra, 2010). Moringa leaf extracts foliar spray improved crop performance, resulting from its role on vigorous plant growth, maintained optimum

tissue water status, improved membranes stability and enhanced antioxidant content as mentioned by Anwar and Bhanger (2003). Also, several studies showed that moringa leaf extract significantly increased plant height in the different plant (Makkar et al., 2007; Fuglie 2000). It was also shown that spraying Moringa oleifera leaf extract caused a noticeable improvement in branches number of different vegetable crops (Culver et al., 2012; Basher et al. (2014)).

Conclusion

Moringa tree has a multipurpose use, is well adapted, and has significant economic importance. It has vital agricultural, nutritional and medicinal applications. This given multi uses of moringa and the wide range of adaptability; makes it an ideal crop for sustainable food production that thrives as the climate changes. It appears that moringa leaf extract has potential use in agriculture sectors to improve the growth and productivity of vegetable crops. It is considered one of the new trends that support sustainable agriculture and organic farming principles. The use of moringa leaf extract should grow in popularity and lead to the development of a large number of moringa extract products. Furthermore, the wild miracle tree (M. peregrina) in Jordan should receive attention.

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