

Research Article

Jojoba and Climate Change

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Abstract

Jojoba (*Simmondsia Chinensis* (Link) Schneider) one of the xerophyte plants belonging to Simmondiaceae family, it is a perennial evergreen woody shrub that grows up to (2-4 m) height, that produces small seeds which contain precious liquid wax Jojoba could play a significant role in protecting the environment and provide proper income for a poor community in marginal lands, jojoba tolerant for salinity and drought stresses, also, jojoba tolerate irrigation with different types of water and could grow in all types of soil except heavy clay soil. There are numerous benefits of jojoba cultivation include develop the marginal lands in arid and semi-arid regions, improve local communities' income, protect the environment, fighting desertification.

Keywords: Climate change; Drought; Jojoba; Soil Salinity

Introduction

Due to the climate changes, there is more stress on cultivated lands particularly in arid and semiarid regions worldwide, that includes rising temperature, drought, salinity, Greenhouse emission, and malnutrition, in the same time, there are wide areas of Marginal land not used economically because of the high cost to reclaim, further more, the local communities in these areas typically suffering from poverty and low income and are vulnerable to threats related to food security [1]. Desertification and marginal lands become a constraint for developing countries, increasing salinization of soil and water resources in different regions was a result of both climate conditions and human activities like excessive use of fertilizers, continual application of irrigation water, over-extraction of groundwater, and incorrect drainage [2].

Jojoba is a perennial deciduous evergreen woody oilseed shrub, belonging to the family Simmondiaceae, Jojoba is native to the Mexican Sonora desert and in the South-West of the United States, Jojoba can tolerate salinity up to 6000 ppm and other harsh conditions of arid lands like drought and high temperature, also, it's growing well in different types of soil with good drain from light-textured soils to clay soil [3].

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Jojoba has promising economic potential due to its fruit is composed of high-quality liquid wax reach up to 50% of seed weight approximately, so, there is a rapid growth in the global production of jojoba due to increased demand for jojoba oil in the global market which expected to continuous growth over the next decades, jojoba used in different industries like cosmetics, medical, and lubricant producing industries, also, it's used to produce biofuel [4]. For that, Jojoba production is considered one of the most practical solutions for marginal land development mainly in Africa, Asia, and South American countries [5]. It is claimed that the cultivation of jojoba on marginal lands will improve the livelihoods of poor communities in developing countries [6]. Due to Jojoba is a drought-tolerant shrub that could be growing under various climatic conditions except frizzing, also, it's adapted to malnutrition conditions, So, Jojoba cultivation could play a vital role in developing local communities and reduce poverty in order to enable marginal land-dwellers to maximize their resource management capacities and increases their income to improve their ability to achieve sustained living [7]. Currently, Jojoba has received more attention from scientists and policymakers as an economic crop to protect the environment through using different types of water like brackish water and wastewater without competing for lands and freshwater, hence, it is a suitable crop for developing marginal lands in developing countries.

There are various aspects of using jojoba include producing cosmetics, medicine for treating skin, protect soil from dilapidation, fighting desertification, and protects the environment through using brackish water and wastewater in irrigation and decrease the emission of carbon dioxide.

Botanical

Jojoba (*Simmondsiachinensis* (Link) Schneider) sole species in Simmondiaceae family is classified as an evergreen shrub that native in Mexican Sonora desert and growing naturally in the South-West of United States, Jojoba is a perennial woody shrub that produces small seeds which contain liquid wax, furthermore, Jojoba bush grows up to (2 - 4 m) height, with a wide, dense crown, carrying opposite oval grey-green waxy thick leaves reach 2–3.5 cm long and 1-1.7 cm width Figure1, carry a header on the branches, which minimize exposure to sunlight [8], also has a strong root system that could penetrate to 9 m down which increase surviving rate under high temperatures and drought conditions [9].

Propagation

Jojoba could be propagated by both seeds and vegetative techniques that including stem cuttings, grafting, and tissue culture, while stem cutting considered the most proper method to produce high-yielding plants. Jojoba could be propagated by both seeds and vegetative techniques that including stem cuttings, grafting, and tissue culture [10].

Propagation by seeds by sowing seeds directly in the field easier but produce high male plants ratio which could reach up 50% which causes missing in yield production with undesirable characters of



Figure 1: (Jojoba leaves (Photo by Dr. Abobatta 2016).

female plants, while, using various vegetative propagation technique could avoid this problem and produce healthy plants with high seed production [11].

Jojoba and climate conditions

Due to harsh climate conditions that include rising temperature, increase drought and decrease perception, elevating carbon dioxide, etc, there is water scarcity particularly in arid and semi-arid regions which reflected in increased soil salinity, therefore, there is more attention to use all water types like saline water and treated wastewater for agriculture[1], so, looking for plant adapted for such water types become reliant in arid and semi-arid countries, whereas, there are wide areas of saline desert in these regions that rarely used, therefore, non-edible crops such as jojoba and *Jatropha* represent a good potential to using different types of water to developing these areas, produce valuable products, and protect the environment from pollution of [12].

Temperature

Jojoba classified as a desert plant that tolerates high temperature and harsh conditions includes drought, high temperature, salinity, malnutrition, etc..., while, it could tolerate low temperature for short period but can't tolerate freezing. Jojoba grows in warm regions with temperature ranging from 20 to 27° c which considered the ideal temperature for the growth and productivity of jojoba, furthermore [3]. Jojoba has a high ability to adapt to high temperature, jojoba could grow in a wide range of temperature ranging from 13 to 42° c, as the high temperature stimulates the vegetable growth, which is positively reflected on enhancing produces dry matter that increases the quantity and quality of the produced oil. Therefore, jojoba could be growing satisfactorily under aridity conditions, so, it could be exploited by the introduction as an economic crop for developing marginal lands in arid and semiarid regions furthermore, jojoba has more attention to cultivation in various arid countries like Australia, Argentina, Chile, Peru, Egypt, and Israel, also, jojoba grown in South Africa and India [13].

Soil

Due to Jojoba nature, it could grow in various soil textures including rough, light, and medium textured, sandy, or gravelly soils, while sandy soil that contains low organic matter considered the proper soil for jojoba growth. Furthermore, Jojoba growing with moderate pH ranging from 5 to 8.5 in different soil types ranging from rough sandy soil to clay soil with good drainage [14], from another side, On another side, Jojoba can't grow under flooding conditions, therefore, all water-logged clay soil improper for jojoba cultivation and must be avoided from any planning for jojoba planting.

The jojoba requires minimum nutrients of established and maintained during the first stages of its cultivation, so, it could grow under poor nutrients conditions Figure2, also, jojoba could tolerate salinity up to 6000 ppm without loss crop and could grow up to 10000 ppm as hedges or to protect the new communities and fight desertification [15].



Figure 2: (Jojoba irrigated with saline water in Egyptian desert (Photo by Dr. Abobatta 2021).

Irrigation

Jojoba water requirements very low compared to other oily crops, jojoba tolerates drought conditions while regular irrigation during growth season improves seeds productivity, adult jojoba shrubs need about 500-600 mm water yearly due to the deep root systems and tolerance of both arid and saline conditions [16]. Jojoba could tolerate irrigation with various types of water including marginal water like brackish water, treated wastewater, and moderate salinity water, which not proper for edible crops.

Fertilizing

The jojoba could grow with a minimum quantity of nutrients and maintenance in the first stages of its cultivation, while, proper fertilizing enhancing flowering and fruit set, therefore, jojoba respond to fertilizing application, so, sufficient fertilizing particularly Nitrogen of adult shrubs could improve growth and seed development and high yield [17].

Economic benefits of Jojoba

The economic importance of jojoba due to its seeds contains a soluble wax usually called jojoba oil, reach up to 50% W/W approximately and considered similar to Whale sperm oil. There is more global interest in cultivating jojoba as an oily shrub that produces a unique type of oil that has promising properties that differ from all vegetarians oils, as it is completely free of glycerol, so, thus remains a liquid wax and does not turn into solid fat, which allows it to be used in multiple fields like cosmetics, pharmaceuticals, and lubricants, also, its uses as a replacement of sperm whale oil, while, the pressing cake waste used as compost in the agricultural sector [18], Jojoba oil is used for various industrial purposes like manufacturing candles, soaps, varnishes, and as a lubricant, also press seedcake is used to produce compost or stock-feeding after removing semmonds in [3].

Due to low requirements of establishment of jojoba, it could be profitable under marginal land conditions even at reasonable prices, therefore, Jojoba considered the ideal crop for developing the marginal land in different areas worldwide particularly in developing countries in different regions like Africa, Asia, and South America. Jojoba offers promise for agriculture in harsh environments where many other crops cannot survive [9].

Jojoba advantage

There are numerous benefits achieved from cultivation in one wonderful jojoba include:

1. Jojoba considered one of the most practical and scientific solutions for marginal land development.
2. Jojoba tolerate harsh conditions include (degradable soil, hot summers, poor nutrient soil, irrigated with low-quality water, and tolerate salinity up to 6000 ppm)
3. Jojoba has great potential to use for rehabilitation as the provision of income to the poor communities.
4. Jojoba has been used to fighting desertification.
5. Long life span, over 100 years in some cases.

Conclusion

Jojoba (*SimmondsiaChinensis* (Link) Schneider) shrubs tolerate various abiotic stress like rising temperature, drought, salinity, heat waves, but cannot tolerate freezing or flooding for long time, Jojoba grow in different types of soil with good drainage and Jojoba could tolerate irrigation with various types of water like brackish water, treated wastewater, and moderate salinity water, which not proper for other crops. Jojoba could play an important role in developing marginal lands particularly in developing countries, protecting the environment and fighting desertification.

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