Importance of Ber Cultivation in Dry Land Areas

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Introduction:

The Indian arid zone is spread over about 31.7 m ha area m the states of Rajasthan-Gujarat, Maharashtra, Andhra Pradesh, Punjab and Haryana. Since the major potential area for growing traditional fruit crops have already been exploited, the emphasis is now shifting towards utilization of waste land resources spread in arid areas, where several indigenous fruit crops like Ber can successfully be grown.

The arid regions experience scanty rainfall (100-400 mm), frequent drought with erratic distribution of rains which often results in complete or partial failure of annual crops. However, Ber being perennial hardy fruit tree, gives some income to the resource poor farmers even in the severe drought It can be grown even on marginal land or inferior soil where most other fruit trees either fail to grow or give very poor performance. It is the only fruit crop which can give good production even under rainfed conditions. It can be grown in a variety of soils and climatic conditions ranging from sub-tropical to tropical.

Current status of ber cultivation in global arid zones

Ber (*Ziziphus mauritiana*) cultivation has become increasingly significant in arid and semi-arid regions globally due to its resilience and adaptability to harsh environmental conditions. In countries such as India, Pakistan, and China. Ber has long been an essential crop, providing food, fodder, and economic stability to farming communities in water-scarce regions. India, in particular, a leading producer of Ber, with extensive cultivation in the arid regions of Rajasthan, Gujarat, and Maharashtra. The crop has also gained traction in other parts of Asia and Africa, including countries like Thailand, Sudan, and Kenya, where it is valued for its drought resistance and minimal water requirements. In the Middle East, particularly in the arid regions of Saudi Arabia and the United Arab Emirates, Ber is cultivated on a smaller scale, often as part of agroforestry systems that aim to combat desertification. The cultivation practices in these regions are primarily traditional, with limited adoption of modern agronomic techniques, leading to variable yields and quality. Despite its potential, the global expansion of Ber cultivation is constrained by challenges such as limited access to improved cultivars, inadequate irrigation infrastructure, and lack of awareness among farmers about best practices. Overall, while Ber cultivation is well established in some parts of the world, its full potential in global arid zones remains untapped. Addressing these challenges through research, extension services, and policy support could significantly enhance Ber production and contribute to sustainable agriculture in these vulnerable regions.

Importance and uses of different parts of ber:

FRUIT: The Ber fruits are rich in vitamin C and sugar with fair number of mineral constituents. Ber is richer than apple in protein, phosphorus, calcium, carotene and vitamin C and excel oranges in phosphorus, iron, vitamin C, calorific values and carbohydrates. According to FAO/WHO recommendation, the daily diet of an adult man should contain 30 mg ascorbic acid. This requirement can be met by including three Ber fruits in daily diet. Besides, the use of fruits as dessert purpose, it can also be processed to prepare preserve, candy. Dehydrated Ber, jam and ready to serve drink. The fruits are laxative, invigorating, remove burning sensation, alleviate thirst, control vomiting, and blood disorders. The astringent seed is a tonic for heart and brain.

Amount (Nutritive composition of Ber fruit Constituents: per 100 g)

- Moisture (g): 81.6–83.0
- Protein (g): 0.8
- Fat (g): 0.07
- Fibre (g): 0.60
- Carbohydrates (g): 17.0
- Total sugars (g): 5.4–10.5
- Reducing sugars (g): 1.4–6.2
- Non-reducing sugars (g): 3.2–8.0
- Ash (g): 0.3–0.59
- Calcium (mg): 25.6
- Phosphorus (mg): 26.8
- Iron (mg): 0.76–1.8
- Carotene (mg): 0.021
- Thiamine (mg): 0.02–0.024
- Riboflavin (mg): 0.02–0.038
- Niacin (mg): 0.7–0.873
- Citric acid (mg): 0.2–1.1
- Ascorbic acid (mg): 65.8–76.0
- Fluoride (ppm): 0.1–0.2
- Pectin (% dry basis): 2.2–3.4

LEAVES: Ber leaves have good source of fodder for desert animals such as sheep, goat, camel and cattle. In arid regions, it is more popular, because of its ability to grow and

regenerate quickly even under environmental stress, the leaves are rich in protein and minerals.

BARK: The bark is used in diarrhoea, it is used as decoction in fever and its powder is applied to ulcers and wounds. It is also used in treating conjunctivitis: The bark is also used in Ayurvedic and umami medicine in treating stomatitis, gum bleeding. asthma and liver complaints.

Branches: After collecting the leaves from Ber plant, the left over highly thorny branched portion will form very good fencing material. The use of bushes for preparing boundaries around houses, farms (rural household) is a well-known practice. Such bushes are also used to protect the heaps of grasses (meant for storage) from stray animals. The commercial Ber also yield large quantity of fencing material as a result of annual pruning. During pruning some of the thick dried and undesirable branches are removed, which constitute very good fuelwood and can produce good quality charcoal. The quantity of fuelwood/fencing material produced is dependent on severity of pruning.

Timber wood: The wood of Ber tree may not have much value as timber but the wild type (*Z .rotundalifolia*) is moderately durable and can be used in a variety of purposes such as house post, handles of agricultural Implements and other tools, tent pegs, posts of charpai etc.

Lac culture: Ber trees are considered as one of the best hosts for raising of lac insects. Lac yield Up to 1.5 kg per tree per year was obtained by collecting it during October -November. By using 6-8 and 2-3 m long shoots of 2-3 cm thickness on a stump for inoculation by lac insect, yield of 3-6 kg of raw lac can be obtained in three years. However, in such cases, fruit production has to be foregone.

Ecophysiological adaptations of ber to arid environments:

Ber (*Ziziphus mauritiana*), known for its resilience in challenging climates, exhibits a range of eco physiological adaptations that make it exceptionally suited for cultivation in arid environments. These adaptations include

1. Deep tap root system. The roots of Ber can penetrate deep into the soil, allowing it to access water reserves far below the surface.
2. Ber roots have a high level of hydraulic conductivity, enabling efficient water uptake and transport even under drought conditions.
3. Ber leaves are small, thick, and covered with a waxy cuticle, which reduces the surface area exposed to sunlight and limits water loss.
4. The stomata, or pores on the leaf surface, are also strategically adapted to close during the hottest parts of the day, further conserving water.
5. Ber also exhibits remarkable tolerance to high temperatures. The leaves contain heat shock proteins and other protective compounds that stabilize cellular structures and enzymes, preventing heat-induced damage.
6. The plant's photosynthetic machinery is adapted to function efficiently under high light intensities and temperatures, ensuring sustained growth and productivity even during the peak of summer.
7. In terms of nutrient acquisition, Ber trees are highly efficient in utilizing the scarce nutrients available in arid soils.
8. They have a symbiotic relationship with enhance mycorrhizal fungi, which nutrient uptake, particularly phosphorus, a limiting nutrient in many arid soils.
9. Moreover, Ber's ability to produce fruit under these harsh conditions is supported by its flexible reproductive strategies. The tree can flower and fruit multiple times a year, ensuring that even if one reproductive cycle fails due to adverse conditions, others may succeed.

Theses phenological plasticity is a critical survival mechanism in unpredictable arid environments. Overall, the Eco physiological adaptations of Ber underscore its potential as a key crop for arid regions. By harnessing these natural traits, Ber production can be optimized to provide sustainable livelihoods in areas where traditional agriculture struggles to succeed, thereby addressing both environmental and socioeconomic challenges in arid zones.

Role of ber in agroforestry systems for sustainable horticulture in arid zones:

Ber (*Ziziphus mauritiana*) offers a promising role in agroforestry systems within arid zones, where traditional agriculture faces significant challenges. Its integration into agroforestry systems can enhance sustainability and resilience in these regions, contributing to both environmental and economic benefits. In arid environments, where water scarcity and soil degradation are prevalent, Ber trees provide valuable ecological functions such as:

1. Their deep root systems access moisture from deeper soil layers, reducing competition for water with shallow-rooted crops. This adaptation not only sustains Ber trees during dry periods but also helps in maintaining soil moisture levels, benefiting associated crops.
2. Ber trees contribute to soil fertility through the accumulation of organic matter from leaf litter, which improves soil structure and nutrient content.

The inclusion of Ber in agroforestry systems can also help mitigate soil erosion.

3. The dense canopy of Ber trees reduces wind and water erosion, stabilizing soil and preventing further land degradation. This protective role is crucial in arid zones, where erosion can rapidly degrade land quality and reduce agricultural productivity.
4. Economically, Ber's integration into agroforestry systems provides diversified income streams for farmers. In addition to the fruit, which has market potential both locally and internationally, Ber trees offer timber and fodder, enhancing the economic resilience of farming households.
5. The ability to cultivate Ber alongside other crops or livestock maximizes land use efficiency and reduces the risk of total crop failure due to adverse conditions.
6. Moreover, Ber based agroforestry systems promote biodiversity by creating habitats for various species, thus supporting ecological balance. This biodiversity, in turn, can contribute to natural pest control and pollination, further enhancing agricultural productivity.
7. Ber plays a vital role in agroforestry systems in arid zones by improving soil health, reducing erosion, and providing economic benefits.

Integration of Ber into these systems supports sustainable agriculture by enhancing both environmental stability and farmer livelihoods.

Environmental benefits of ber cultivation, soil stabilization and desertification control:

The cultivation of Ber (*Ziziphus mauritiana*) in arid zones offers significant environmental benefits, particularly in soil stabilization and desertification control. As these regions grapple with severe soil erosion and land degradation. For effective environmental restoration and sustainability Ber has unique characters such as.

1. Deep and extensive root systems play a crucial role in soil stabilization. By anchoring the soil and preventing erosion, Ber trees help maintain soil structure and reduce surface runoff, which is vital in regions prone to wind and water erosion .
2. The root systems of Ber trees also improve soil aeration and enhance the infiltration of water, contributing to the overall health of the soil. In addition to soil stabilization, and desertification control. Desertification is a major concern in arid and semi-arid regions, where the loss of vegetation cover leads to the expansion of desert areas.
3. Ber trees, with their ability to thrive in nutrient-poor soils and withstand extreme conditions, help combat desertification by providing a vegetative cover that protects the soil from wind and water erosion.
4. The presence of Ber trees increases organic matter content in the soil, which improves soil fertility and promotes the growth of other plants.
5. Furthermore, Ber orchards contribute to the creation of microclimates that can enhance local biodiversity.
6. The shade provided by Ber trees can create a more favourable environment for other plant species, leading to increased plant diversity and ecological resilience.

This, in turn, supports a variety of wildlife and contributes to the overall health of the ecosystem. And also desertification is a major concern in arid and semi-arid regions, where the loss of vegetation cover leads to the expansion of desert areas which can be controlled by Ber cultivation as it offers a valuable environmental benefits in arid zones by stabilizing soil, controlling desertification, and enhancing biodiversity, and to improve soil health and mitigate land degradation makes it a vital component of sustainable agricultural practices in these challenging environments.

Market opportunities and challenges for ber fruits in arid regions:

The market for Ber (*Ziziphus mauritiana*) fruits in arid regions presents a mix of opportunities and challenges that are pivotal for the success of its cultivation. On the opportunity side, the growing demand for Ber fruits in both domestic and international markets offers significant income potential for farmers. The fruit nutritional benefits, including high vitamin-C content and antioxidant properties, have increased its appeal among health-conscious consumers, further driving demand. Additionally, the versatility of Ber fruits, which can be consumed fresh or processed into products such as dried fruits, candies, and beverages, opens up diverse revenue streams, adding value to the crop.

However, several challenges hinder the full exploitation of these market opportunities. One of the primary challenges is the lack of established marketing channels and infrastructure in many arid regions. Farmers often face difficulties in accessing markets, leading to lower profitability. The absence of efficient storage facilities exacerbates post-harvest losses, reducing the quantity of

marketable produce. Moreover, price volatility and competition from other fruit crops in the market can also impact the income stability of Ber producers. To overcome these challenges, there is a need for improving processing facilities, as well as the development of reliable market linkages. Additionally, promoting awareness of Ber's health benefits can help in creating a niche market, potentially leading to higher returns for farmers in arid regions

Conclusion

Ber (*Ziziphus mauritiana*) holds significant promise for enhancing agricultural sustainability and food security in arid zones, given its adaptability to harsh environmental conditions. The crop's drought tolerance, minimal water requirements, and ability to thrive in nutrient-poor soils offer a viable solution to the challenges posed by arid climates. However, maximizing its potential requires addressing key challenges, including improving agronomic practices, pest and disease management, and market access. Research and extension services must focus on developing high-yielding, pest-resistant cultivars and disseminating knowledge to farmers. Additionally, investments in infrastructure and policy support are crucial for facilitating market access and ensuring profitability. By overcoming these obstacles, Ber production can contribute to environmental sustainability, boost rural economies, and offer a resilient agricultural model for arid regions facing the impacts of climate change. Future efforts should prioritize these areas to fully realize the benefits of Ber cultivation.

References

Rashwan, A. K., Karim, N., Shishir, M. R. I., Bao, T., Lu, Y., & Chen, W. (2020). Jujube fruit: A potential nutritious fruit for the development of functional food products. *Journal of Functional Foods*, *75*, 104205.

Arumugam, J., Thambidurai, S., Suresh, S., Selvapandiyan, M., Kandasamy, M., Pugazhenthiran, N., ... & Quero, F. (2021). Green synthesis of zinc oxide nanoparticles using Ficus carica leaf extract and their bactericidal and photocatalytic performance evaluation. *Chemical Physics Letters*, *783*, 139040.

Aslam, M., Prathapar, S. A., & SA, P. (2006). Strategies to mitigate secondary salinization in the Indus Basin of Pakistan: a selective review.

Ayars, J. E., Christen, E. W., & Hornbuckle, J. W. (2006). Controlled drainage for improved water management in arid regions irrigated agriculture. *agricultural water management*, *86*(1-2), 128-139.

Ahmad, A., & Ali, A. (2019). Improvement of postharvest quality, regulation of antioxidants capacity and softening enzymes activity of cold-stored carambola in response to polyamines application. *Postharvest Biology and Technology*, *148*, 208- 217.

Beltrán, J. M., & Koo-Oshima, S. (2006). Water desalination for agricultural applications. *FAO Land and water discussion paper*, *5*, 48.

Ben-Gal, A., Lazorovitch, N., & Shani, U. (2004). Subsurface drip irrigation in gravel- filled cavities. *Vadose Zone Journal*, *3*(4), 1407-1413.

Ben-Gal, A., Tal, A., & Tel-Zur, N. (2006). The sustainability of arid agriculture: Trends and challenges. *Annals of Arid Zone*, *45*(3/4), 227.

Dayal, H., Lal, G., Singh, Y. V., Kumar, P., & Singh, D. (2010). Effect of nitrogen, phosphorus and zinc on growth and yield of ber cv. Gola under arid and semi-arid conditions. *Indian Journal of Horticulture*, *67*(2), 277-280.

Jain, S., Gavhale, K., Bele, P., Krishnamoorthi, A., Balo, S., Patel, B., & Kumar, L. (2024). Ber Production in Arid Zones: Challenges, Management and Opportunities for the Future. *Journal of Advances in Biology & Biotechnology*, *27*(10), 500-512.

Kavitha, C., Dhami, P., Kuna, A., Sagar, B., & Bhat, G. V. (2014). Study of nutrient composition and value addition of wild ber (zizyphus jujuba). *Biochemical and Cellular Archives*, *14*(2), 311-314.

Krishna, H., & Parashar, A. (2013). Phytochemical Constituents and Antioxidant Activities of Some I ndian Jujube (Z iziphus mauritiana Lamk.) Cultivars. *Journal of Food Biochemistry*, *37*(5), 571-577.

Sunil Kumar, S. K., Roy, M. M., & Tewari, R. K. (2008). Studies on bench grafting in ber in relation to scion thickness and graft storage.

Dalal, N., Neeraj, B. V., Raj, N., & Bisht, V. (2019). Value added products from Ber. *International Journal of Current Microbiology and Applied Sciences*, *8*(1), 1603-1615.

Jawanda, J. S., & Bal, J. S. (1978). The ber-highly paying and rich in food value.

Pareek, S., & Dhaka, R. S. (2008). Association analysis for quality attributes in ber. *Indian Journal of Arid Horticulture*, *3*, 77-80.

Pareek, S., & Yahia, E. M. (2013). Postharvest biology and technology of ber fruit. *Horticultural Reviews Volume 41*, 201-240.

Rathore, M. (2009). Nutrient content of important fruit trees from arid zone of Rajasthan. *Journal of Horticulture and Forestry*, *1*(7), 103-108.

Singh, B., & Pathak, S. (2016). Evaluation of cultivars and packing materials during preparation and storage of ber candy. *Journal of Applied and Natural Science*, *8*(2), 630.

Vithlani, V. A., & Patel, H. V. (2010). Production of functional vinegar from Indian jujube (Zizyphus mauritiana) and its antioxidant properties.

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