*SKUAST Journal of Research* 25(2): 363-366; (2023)
(*10.5958/2349-297X.2023.00036.3*); NASS rating: 4.17

**Short Communication**

# Empirical study on value added environment centric uses of mulberry crop

Aina Bhat[1*] and Naveed Hamid[2]

[1]*College of Temperate Sericulture, Mirgund;* [2]*Sericulture Pathology, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar-190025, Jammu and Kashmir (India)*
*e-mail: *bhatnaveedbhat@gmail.com*

(Received January 31, 2023; accepted March 04, 2023)



ABSTRACT

**Mulberry is a hardy, fast-growing perennial plant belonging to the Moraceae family, genus Morus. Mulberry is a woody, deciduous, and economically valuable tree that is moderately resistant to a variety of environmental stresses (drought, water-logging, salinity, heavy metals etc). Mulberry leaves are used to feed the silkworm, Bombyx mori which produces silk thread. Mulberry trees can grow in a wide range of climates and soil environments, from temperate to subtropical regions in the northern hemisphere to the tropics in the southern hemisphere. Mulberry trees' positions in the prevention and monitoring of desertification, water and soil conservation, saline-land management, and other issues have gotten renewed interest as people have become more concerned about the state of the environment. Mulberry trees have also been increasingly investigated for their potential as a source of other items other than silkworm food.**

**Key words:** Atmospheric pollutants, environment, moraceae family, morus, mulberry, soil

With the exponential expansion of manufacturing, automation of agriculture, transportation, and an overburdened urban population, anthropogenic toxic contaminants have been introduced into the atmosphere, soil, and ground water, posing significant risks to the receiving environment's ability to self-purify. As a result, the cumulative contaminants' toxicity are increased which is of great concern to both human body and the ecosystem.

Mulberry is a versatile plant that grows well in a variety of soils, both irrigated and unirrigated. It is a deep-rooted plant that produces a large number of leaves, which are essential for the silkworm crop's survival. Mulberry is a member of the Morus family, which includes 68 species (Datta, 2000), is a perennial woody plant that, after proper establishment, will reach maximum yielding capacity in the second year and last for over 17 years without major leaf yield degradation (Ahmed *et al.,* 2020). Mulberry is a hardy, pollution-resistant, and easy-to-grow herb. Isms like "go green" and "eco-friendly" have been trendy in recent years. The term "eco-friendly" simply refers to something that is not detrimental to the climate. Increased levels of harmful chemicals in the atmosphere, soil, and ground water are currently posing significant risks to the climate, and human health. It may be the result of accelerated industrialization, deforestation, transportation, and overcrowding in cities. The use of perennial woody plants, which have salient characteristics such as a large root system, high biomass production, and good environmental adaptability, produced a promising outcome in stabilizing the negative effects of heavy metals in a variety of contaminated soils (Zhou *et al.,* 2015). Mulberry leaf has been shown to be effective in reducing emission levels due to its high absorption capacity. The mulberry garden's water retaining capability is said to be greater than that of open space. Mulberry has a number of distinguishing characteristics that have been linked to its use in pollution control (Jian *et al.,* 2012). The following are some of the benefits of mulberry to the atmosphere in terms of mitigating the problems that have arisen as a result of pollution:

**The role of mulberry in environmental management:**

**Table 1. Some heavy metal contents of mulberry leaf and fruits at different distances from the road (mg kg$^{-1}$)**

| Distances from road (m) | Zn | | Mn | | Cu | | Co | | Cr | | Pb | | Cd | | Ni | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Leaf | Fruit | Leaf | Fruit | Leaf | Fruit | Leaf | Fruit | Leaf | Fruit | Leaf | Fruit | eaf | Fruit | Leaf | Fruit |
| 20 | 23.88$^{a}$ | 8.74$^{a}$ | 354.4$^{a}$ | 127.2$^{a}$ | 8.26$^{a}$ | 3.14$^{a}$ | 0.72$^{a}$ | 0.26$^{a}$ | 0.61$^{a}$ | 0.23$^{a}$ | 1.28$^{a}$ | 0.47$^{a}$ | 0.06$^{a}$ | 0.020$^{a}$ | 2.02$^{a}$ | 0.75$^{a}$ |
| 100 | 21.96$^{b}$ | 8.21$^{a}$ | 315.8$^{b}$ | 116.3$^{a}$ | 7.46$^{ab}$ | 2.89$^{ab}$ | 0.59$^{b}$ | 0.22$^{a}$ | 0.42$^{b}$ | 0.16$^{b}$ | 1.13$^{b}$ | 0.42$^{ab}$ | 0.04$^{b}$ | 0.015$^{ab}$ | 1.54$^{ab}$ | 0.57$^{ab}$ |
| 400 | 20.62$^{b}$ | 7.73$^{ab}$ | 294.5$^{c}$ | 108.8$^{a}$ | 7.07$^{bc}$ | 2.74$^{ab}$ | 0.39$^{c}$ | 0.14$^{b}$ | 0.35$^{c}$ | 0.14$^{bc}$ | 0.95$^{c}$ | 0.35$^{bc}$ | 0.04$^{b}$ | 0.014$^{b}$ | 1.27$^{bc}$ | 0.48$^{ab}$ |
| 1000 | 18.55$^{c}$ | 5.97$^{b}$ | 234.0$^{d}$ | 74.1$^{b}$ | 6.38$^{c}$ | 2.12$^{b}$ | 0.24$^{d}$ | 0.08$^{c}$ | 0.28$^{d}$ | 0.09$^{c}$ | 0.86$^{c}$ | 0.28$^{c}$ | 0.03$^{b}$ | 0.010$^{b}$ | 0.92$^{c}$ | 0.30$^{b}$ |
| *Mean* | *21.25* | *7.66* | *299.70* | *106.60* | *7.29* | *2.72* | *0.48* | *0.18* | *0.41* | *0.16* | *1.06* | *0.37* | *0.04* | *0.015* | *1.44* | *0.52* |
| *LSD* | *1.87* | *1.92* | *17.51* | *24.87* | *0.93* | *0.79* | *0.11* | *0.06* | *0.06* | *0.05* | *0.116* | *0.09* | *0.01* | *0.006* | *0.502* | *0.29* |
| *P** | *0.0011* | *0.0473* | *0.0001* | *0.006* | *0.0096* | *0.0844* | *0.0001* | *0.0005* | *0.0001* | *0.002* | *0.0001* | *0.0088* | *0.0039* | *0.0329* | *0.0058* | *0.0325* |

**probability values with different letters in a column are significantly different at the 0.05 level according to LSD test, Pehluvan et al.* (2012)



## RESULT AND DISCUSSION

**Adaptability to soil, water conservation and consolidation:** Mulberry trees can adapt to a wide range of soil conditions. Mulberry trees can thrive in deep, porous, fertile soil as well as barren, nutrient-depleted soil (Han. 2007). Mulberry roots in the soil form a twisted and thick network. Mulberry trees are excellent at reducing sand storms and conserving water and soil. In contrast to the standard planting pattern scheme, it is estimated that the runoff co-efficient in mulberry can be decreased by 10-20%. Mulberry tree hedge rows were also found to have a major impact on overall drainage and nutrient enrichment ratios (Shi 2005). Mulberry trees have an important effect in reducing soil erosion, according to Du (2001).

**Suitability of mulberry dyes on silk fabrics using environmentally friendly mordants:** Natural dyes from mulberry leaves were collected using an aqueous process and used to dye silk using various mordants (Loumjanani *et al.,* 2013). The color shades of mulberry dyes were registered, and they differed depending on the mordant used. Above all, the dyes demonstrated adequate color fastness to washing, sun, and light.

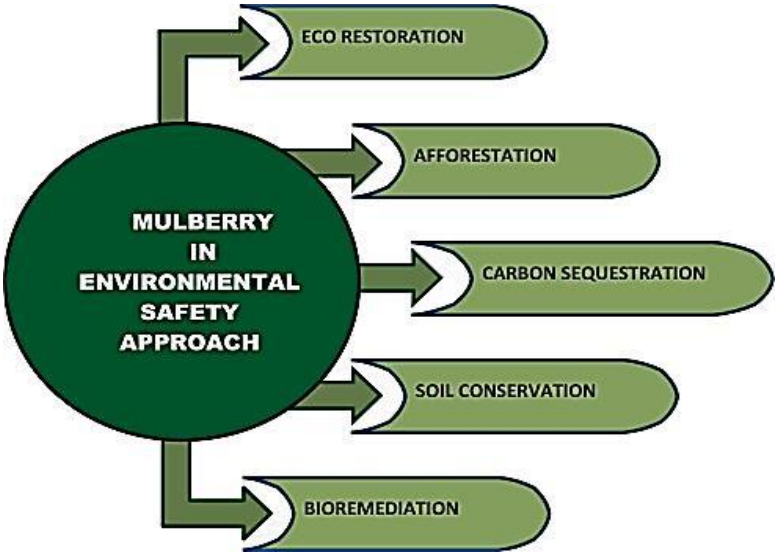


**Fig 1: Mulberry in Environmental Safety Approach (**Rohela *et al.,* 2020)

**Survivability to drought and water logging condition and wide genetic plasticity:** Mulberry plants have a high level of survival and vitality. Mulberry has a higher tendency to adapt in dry areas with annual rainfall below 150 mm, according to Dai *et al* (2009). Adult mulberry trees were found to be able to withstand a 20-day inundation during their growth time, according to research. Among other xerophytic species, this is very unusual. Mulberry trees have a high resistance to water logging while they are dormant. Mulberry trees have shown to have a high level of genetic plasticity, allowing them to adapt to a variety of agro-climatic conditions. The most resistant to chilling are dormant mulberry trees (Chen *et al.,* 2006). Mulberry's hardiness is shown by its distribution pattern across the world, which ranges from temperate to tropical.

**Mulberry in phytoremediation:** One of the most important techniques for removing heavy metals from soils is phytoremediation. Mulberry has the ability to clean up soils that have been polluted with heavy metals (Zhou *et al.,* 2015). Mulberry's evolved root system aids in the absorption of soil nutrients and is also conductive to the absorption of metals in the soil to some degree (Jhothimani *et al.,* 2013). Heavy metals such as pb, cd, and cu are mostly remediated by mulberry species.

**Sericin of mulberry silkworm for eco- friendly synthesis of silver nano particles:** Many people are interested in green synthesis of silver nanoparticles (AgNps) because it is a simple, cost-effective, and environmentally friendly process. For the green synthesis of AgNps, sericin was isolated from *Bombyx mori,* which feeds on mulberry.

**An eco-friendly slow release urea fertilizer based on waste mulberry branches:** Mulberry branches, a popular crop residue, is used to make an environmentally friendly slow-release urea fertilizer for use in agriculture and horticulture. (Zhang *et al.,* 2014). In addition, preparing vermicompost with leftover mulberry pieces from silkworm rearing will help increase mulberry leaf consistency while lowering chemical fertilizer costs.



**Windbreak and sand-fixation:** Mulberry's drought resistance, cold resistance, barren resistance, massive adaptability, and distribution in China make it ideal for forestation, windbreak, and sand fixation (Wang *et al.,* 2010). Mulberry, which can still grow and thrive naturally in arid, semi-arid desert areas with less than 150 mm of precipitation, has a high vitality (Dai *et al.,* 2009). Mulberry has been one of the favourite plants for windbreak and sand fixation in northern China, including Xinjiang, Shaanxi, Beijing, and other areas. Mulberry, on the other hand, will be an excellent option for treating stony desertification in the south, not only as a preferred species for tailings reservoir maintenance, but also as a cure for stony desertification. The underground root system is a massive network that has a positive impact on soil and water quality (Whitfield, 2007)

**Modified saline soil:** Mulberry is an excellent tree for saline alkali soil improvement. It can thrive in a pH range of 4.5 to 9.0 and 0.2 percent soil salinity (Ke, 2008). Mulberry could survive in areas of the saline alkali soil in Heilongjiang Province, China, at pH values of 8.3-9.5. Three years later, the salt content of the soil had greatly reduced, the water content had clearly increased, and the physical and chemical properties of the soil had changed (Gao and Han, 2013).

**Improvement of air quality:** Mulberry trees are excellent carbon sinks. Any year, a 1 m mulberry tree is expected to consume 4162 kg of carbon dioxide and emit 3064 kg of oxygen. Mulberry leaves also have a high absorbing potential for atmospheric contaminants such as chlorine, hydrogen fluoride, and sulphur dioxide, among others. Mulberry leaves were shown to be unaffected by elevated levels of chlorine emissions in the atmosphere, indicating that the mulberry plant has a natural tolerance to chlorine (Lu. *et al.,* 2004).

Mulberry is an ideal plant for the city landscape because of its tree shape, leaf colour, vitality, ductility, and resistance (Jian *et al.,* 2012). Mulberry leaves can lower wind speed and accumulate and detain big particle dust on their surfaces. A hectare of mulberry will produce 27.2 tons of dust per year on average. Mulberry is a healthy green tree plant that has been planted on both sides of the road for this purpose. Mulberry leaves have a high ability to absorb toxins from the air. In the sericulture market, if the mulberry garden was near an industrial zone, particularly sericultural farmers who lived in areas where the industrial park's perennial winds blew downwind, the silkworm, *Bombyx mori,* was frequently poisoned as a result of eating mulberry leaves polluted by contaminants in the air.

**Water retention**: Mulberry trees can help to increase soil permeability, minimize surface runoff, and keep water in the ground. Mulberry tree canopy interception could account for 15 percent to 40 percent of the rainfall. Furthermore, the penetration rate and coefficient of permeability of soil in a mulberry garden were 1.91 and 3.07 times, respectively, those of open space. As a result, 50-70 percent of rainfall can percolate into the ground and become groundwater. Because of canopy interception and garden storage, the real rainfall only produced a limited water drain, accounting for only 4% of the total rainfall. Finally, the weed underneath the mulberry could create a shield, reducing flow speed without causing runoff or soil erosion (Tan *et al.,* 2010).

## CONCLUSION

The mulberry has a strong ecological impact in the application of soil and water conservation, desertification regulation, saline and alkali land management, and sand protection forest in recent years, particularly the restoration of heavy metals in soil, due to its wide distribution, high biomass, established root, and wide range of ecological adaptability.

## REFERENCES


Ahmed, F., sultana, R., Alam, M.J., and Ahmed, Q. 2020. Elevated Potassium Enhances Leaf Productivity and Suppresses Foliar Diseases of Mulberry Plant. *Journal of Agricultural Studies,* 8**:**90

Chen MG, Jin PH, Huang LX, and 2006.Energy analysis of mulberry-silkworm ecosystem in China. *Chinese Journal of Applied Ecology*, 17**:**233-236.

Dai,Y.W., Zhu, H. And Du, H.Z. 2009. An evaluation on economic value and ecological function of mulberry resources. *Journal of Protection Forest Science and Technology **1**:78-80*

Datta, R.K. 2000. Mulberry cultivation and utilisation in India. *Proceedings of the Electronic Conference.*

Du, Zh., Liu, JF. and Liu G. 2001. Study on mulberry trees as both water and soil conservation and economy trees. *Journal of Guangxi Sericulture*. 38:10-12.

Gao,Q. and W. H. 2013. The thinking of planting mulberry to develop and improve saline-alkali land in Heilongjiang province, china .agri. develop and equip **5:** 6-6. (In Chinese).

Han.S.Y. 2007.The ecological value of mulberry and its ecological cultivation models for planting mulberry from eastern to western areas in Guizhou. *Journal of Guizhou Agricultural Sciences* **35**:140-142.

Janani , L. and Winiferd, D. 2013. Suitability of dyes from mulberry and coffee leaves on silk fabrics using ecofriendly mordants. *International Journal of Scientific and Research Publications, **3**:11,*

Jian,Q., Ningjia, H, Yong., W, Zhonghuai., X. 2012. Ecological issues of mulberry and sustainable development. *J. Resour. Ecol.* 330-339

Jothimani, P., PonmaniI,S.and Sangeetha. 2013. Phytoremediation of heavy metals a review. *International Journal of Research Studies in Bioscience **1**:17-23.*

Lu M, Wang RQ and Qi XS. 2004. Reaction of planting tree species on chlorine pollution in the atmosphere. *Journal of Shandong University*. 98-101.

Pehluvan M, karlidag H. and Turan M. 2012. Heavy metals levels of mulberry *(Morus alba.)* grown at different distances from the roadsides. *The journal of animal and plant sciences.* **22**: 665-670

Rohela G.K, Shukla. P, Muttana, kumar, R., Chowdhury, SR.2020. Mulberry (Morus spp.): An ideal plant for sustainable development. Trees, forests and people.

Shi, D.M., Lu, X.P and Liu, L.Z. 2005. Study on functions of soil and water conservation by mulberry hedgerow intercropping of purple soil slopping farmland in three gorges reservoir region. *Journal of Soil Water Conservation*. **19**:75- 79.

Tan, C., Feng, Y and Long, H. 2010. The important role of mulberry in low carbon and ecological economy of china. *Sichuan Canye, **1**: 12-15.*

Wang, H., Meng, B. and HAN, H. 2010.The discussion on mulberry as a green afforestation tree species. *North Sericulture,* 31***:*** 45-47.

Zhang, Y., Yang, X., Liu, H., YAO, J.2014. *ACS systainable chemistry and engineering*

Zhou, L., Zhao, Y., shuifeng, W.and Han, S. 2015.Lead in the soil–mulberry (*Morus alba* L.)–silkworm *(Bombyx mori)* food chain: Translocation and detoxification.*Chemosphere* .**12:16**