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Mulberry as a avenue plant

Deepa KB, Vishaka GV and Nithin Kumar DM

Abstract
A tree that requires so little attention and care. The trees that are tolerant to wind, drought, cold and partial shade so you can pretty much plant them anywhere. Mulberry is one of the fastest growing trees not many plants offer so much to the grower while demanding so little in return. Mulberry commonly invades old fields, roadsides, forest edges, urban environments, and other disturbed areas. Mulberry Trees are good carbon sink plants. It is estimated that 1 mμ mulberry tree is able to absorb about 4162 kg of carbon dioxide and release 3064 kg of oxygen each and every year. Mulberry leaves have also high adsorption capacity to assimilate certain air pollutants hence these plants can be used as avenue plants and will absorb and clean water that runs over the road. Thus they can reduce flood, soil erosion, air pollution. Therefore, mulberry can be used as avenue plants. The advantages of using mulberry as a avenue plant they require less investment and management.

Keywords: Mulberry, avenue plant.

Introduction
Mulberry is a fast-growing deciduous woody perennial in the family Moraceae, consists of diverse species of deciduous trees commonly known as mulberries, mulberries growing wild and under cultivation in many temperate world regions, having stronger environmental adaptability. Mulberries are fast-growing when young, and can grow to 24 metres (80 ft) tall. The trees develop deep taproots that should be able to access ground water if available. Fast growth and tolerance to pruning makes this a great chop and drop plant. Growth can increase soil fertility through litter fall. They are resistance to pruning, their low water requirements and tolerance to pollution make them very suitable plants for urban conditions, house gardens, street shade and city embellishment. They are often grown on roadsides as avenue tree. It's deep-rooting habit and drought tolerance makes it a suitable tree for avenue planting. The fast growing nature of the tree and it's tolerance to wind makes it great candidate for windbreaks and biomass belts. Mulberry leaves have also high adsorption capacity to assimilate certain air pollutants like chlorine hydrogen fluoride and sulphur dioxide etc. It is observed that mulberry leaves remained undamaged under higher level of chlorine pollution to the atmosphere, thus mulberry plant considered to have natural resistance to chlorine (Lu *et al*., 2004) [4]. They prefer a warm, moist, well-drained loamy soil in a sunny position. However they are adapted to coarse, medium, and fine soils. They tolerate a pH range of 5.0–7.0

Air pollution control
At present the occurrence of increased level of toxic pollutants to the atmosphere, soil and ground water has caused serious threats to the environment ecology and human health. Mulberry leaf with its strong absorption ability found to be useful in controlling atmospheric pollution and Global warming.
Mulberry trees are good carbon sink plants. It is estimated that 1 mμ mulberry tree is able to absorb about 4162 kg of carbon dioxide and release 3064 kg of oxygen each year. Mulberry leaves have also high absorption capacity to assimilate certain air pollutants like chlorine, hydrogen fluoride and sulphur-di-oxide etc. It is observed that mulberry leaves remained undamaged under higher level of chlorine pollution to the atmosphere, thus mulberry plant considered to have natural resistance to chlorine (Lu 2004Mulberry trees acts as good carbon sink plants. It is estimated that 1 mu mulberry trees can absorb about 4162 kg of CO2 (equivalent to 135 kg of carbon) and release 3064 kg of oxygen each year (1 ha=15 mu). Mulberry is an ideal tree species for city landscape due its excellent features in tree form, leaf colour, growth vigour, tenacity and resistance. Mulberry is drought and flood resistant. In addition, mulberry leaves have capacity to absorb air pollutants such as Cl, HF, SO2.Mulberry is a first-class resistant tree species against sulfur dioxide pollution. It has also high resistance to chlorine pollution. It can be planted along river sides, at field edges, on slopes, at garden corners, along roadsides, in public parks and other recreation places.

The gardener's plant mulberry along the boundaries of apple orchard with the aim that rats don't damage their apple trees and it is proved right because mulberry roots release some chemicals which kill the rats. Mulberry plants are grown as street trees in some cities. Liu *et al*. (2004) [4] reported that soil temperature of terrace land with mulberry embankment was 0.8-1.0 □ higher than that without it during raining season of July to August. This confirms that mulberry tries to optimize the soil temperature depending upon environmental conditions and thus keeps the favorable conditions to promote growth and increase in yield of the crop. The 0-20 cm earth temperature was 1.7 □ lower and the maximum water holding capacity of the soil was 20.57% higher (Xiao and Shi 2006) [11]. Mulberry embankment reduces air temperature and increases air humidity. It also increases air temperature while the climate turned to cold. The mulberry trees were planted in the ridges of the terrace land for three years, compared to agriculture land without mulberry plantation, erosion ditches of the land with mulberry embankment were 35.7%less, 59.2% shorter,61% narrower and 64% shallower (Liu *et al*., 2007) [4].

Mulberry trees are good carbon sink plants. It is estimated that 1 mμ mulberry tree is able to absorb about 4162 kg of carbon dioxide and release 3064 kg of oxygen each year. Mulberry leaves have also high absorption capacity to assimilate certain air pollutants like chlorine, hydrogen fluoride and sulphur-di-oxide etc. It is observed that mulberry leaves remained undamaged under higher level of chlorine pollution to the atmosphere, thus mulberry plant considered to have natural resistance to chlorine (Lu 2004 Mulberry trees acts as good carbon sink plants. It is estimated that 1 mu mulberry trees can absorb about 4162 kg of CO2 (equivalent to 135 kg of carbon) and release 3064 kg of oxygen each year (1 ha=15 mu). Mulberry is an ideal tree species for city landscape due its excellent features in tree form, leaf colour, growth vigour, tenacity and resistance. Mulberry is drought and flood resistant. In addition, mulberry leaves have capacity to absorb air pollutants such as Cl, HF, SO2.Mulberry is a first-class resistant tree species against sulfur dioxide pollution. It has also high resistance to chlorine pollution. It can be planted along river sides, at field edges, on slopes, at garden corners, along roadsides, in public parks and other recreation places. The gardener's plant mulberry along the boundaries of apple orchard with the aim that rats don't damage their apple trees and it is proved right because mulberry roots release some chemicals which kill the rats. Mulberry plants are grown as street trees in some cities. Liu *et al*. (2004) [4] reported that soil temperature of terrace land with mulberry embankment was 0.8-1.0 □ higher than that without it during raining season of July to August. This confirms that mulberry tries to optimize the soil temperature depending upon environmental conditions and thus keeps the favorable conditions to promote growth and increase in yield of the crop. Mulberry embankment reduces air temperature and increases air humidity. It also increases air temperature while the climate turned to cold.

Soil and water erosion control

Mulberry has very strong root system. The water retention capacity in the mulberry garden is reported to be higher than that of the open land. Its roots form a greatly tangled and dense network in the soil. Mulberry plantation is highly capable of suppressing sand storm and conserving water and soil. It is estimated that the runoff co-efficient can be reduced by 10-20% in mulberry in comparison to the traditional planting pattern system. It is also reported that mulberry tree hedgerow had significant effect in reducing total runoff and enrichment ratio of nutrients (Shi 2005) [11]. Du (2001) [3] experimentally reported that mulberry trees have significant effect in preventing soil erosion. For instance, the annual runoff volume was reduced by 38 and 91% under the 5 and 10 year old mulberry bush belt respectively than the agricultural slope land. Mulberry root system can effectively improve the shear strength of purple soil and increase anti-erosion capacity of soil. Incidences of natural calamities (like flood and drought etc.), abrupt soil erosion, high rate of disease outbreak are some of the phenomena assumed to have direct consequences with environmental pollution. Mulberry possesses several important characteristic features and reported to be useful in controlling environmental pollution. This section illustrates environmental importance of mulberry to mitigate the challenges emerged due to environmental pollution.

Mulberry has very strong root system. Its roots form a greatly crossed and densely network in soil. Mulberry plantation is highly capable of suppressing sand storm and conserving water and soil. Mulberry root system can effectively improve the shear strength of soil and increase anti erosion capacity of soil. As per Nan *et al*. (2011) [10] soil shear strength was increased from 75.2kPa to 138.4kPa while soil layer was depended from 0-10 cm to 30-40 cm in mulberry field. Mulberry is highly capable of resisting drought and other natural hazards. It is also very effective in resisting wind and consolidating sand and soil. At present mulberry, has been used as an ecological tree species for water and soil conservation and management of ecological environment. Under PH value of 4.5-8.5 and salt content 0.2% they still grow normally (Su 1998) [12]. That is the reason mulberry trees have wide distribution and vigorous growth. Mulberry trees have very strong vitality. In arid or semiarid desert area with annual rainfall less than 300-600mm, they still grow under natural condition. Even in desert area with annual rainfall less than 150 mm, they could also grow and develop (Dai *et al*., 2009) [2]. Owing to long period natural and artificial selections mulberry ecotypes with different drought resistance features have been detected. Under abundant soil moisture supply the transpiration coefficient of mulberry trees was 350450 (Lv, 2008). Under drought stress net photosynthetic rate transpiration rate and water utilization efficiency of mulberry leaves were decline (Ji *et al*., 2004). The transpiration coefficient of some drought resistant mulberry varieties low as 274, being lower than that of Populus diversifolia (300), Elaeagnus angustifolia (383), seabuckthorn (483) and poplar (513). The wilting coefficient of some drought resistant mulberry varieties is 9, being lower than that of wild apricot, white elm (13) and Poplar (13), demonstrating that mulberry adapts to dry climate (Hu and Zhou, 2010). Investigations showed that adult mulberry trees could survive from an inundation of 20d during their growth period. This is very rare among other xerophytic plants. Mulberry trees have very strong endurance to waterlogging in dormant stage. Mulberry being a tree species with best growth after emergence of the hydro fluctuation belt (He *et al*., 2007) [5]. Mulberry trees can resist chilling and freezing of -30 □ and endure high temperature of 40 □ (Zhao 2009) [13]. Dormant mulberry trees have highest resistance against chilling and it has also certain resistance against chilling at growth stage (Chen *et al*., 2006) [1].

Conclusion

Mulberry is a fast-growing woody plant characterized by deep roots, flourish leaves, high resistances to pollution, wind, sand, drought, and salinity with strong adaptability and easy cultivation. The broad ecological adaptability of mulberry to light, temperature, water, soil and other natural conditions objectively enables it to have multiple ecological protective functions in water and soil conservation, wind resistance and sand consolidation, water source preservation, and air refreshment. As a traditional economic woody plant, mulberry also has great values for comprehensive development and utilization. It is an excellent tree species with both ecological and economic benefits for water and soil conservation and ecological environment construction. At the present, ecological safety has become one of the important components of national safety. Development of ecological mulberry not only plays important roles in comprehensive control of ecological environment but also realizes higher level sustainable development of nature-resource-economy-society in ecologically vulnerable areas.

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