

ENERGY CRISIS AND MESQUITE

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Abstract

Like vast majority of population in the Third World countries, Pakistan is virtually facing a wood famine. There has been an abnormal rise in the prices of fuelwood during the last few years. One possibility which could go a long way to overcome a major fuelwood crisis in the country is to reconcile with mesquite and grow it systematically in forest plantations particularly in semi-arid and marginal lands where other more valuable forest species cannot be successfully grown. Mesquite grows fast and can tolerate heat and drought and a variety of soils. It is excellent for firewood and makes superior charcoal. It is an exceptionally high yielder of biomass.

Introduction

A vast majority of population in the Third World countries is faced with varying degrees of fuelwood scarcity. According to FAO estimates nearly 1,000 million people in the developing countries live in situation of acute scarcity of fuelwood. This has resulted in a much wider area the current rate of felling trees exceeding than replanting. With growth in population, the pressure on forest resource is mounting and as a consequence, the resource is depleting itself. The indiscriminate felling of trees for fuelwood is also accelerating the process of erosion leading to siltation of dams and frequent onset of floods. The scarcity of fuelwood is also leading to the use of substitutes such as cow dung and agricultural residues a practice which reduces the much needed fertilizer for crop production. It has been estimated that if the present trends are allowed to go unchecked, some 2,000 million people will be faced with extreme scarcity of fuelwood by the turn of the century.

In Pakistan the situation is equally bad if not worse and there is virtually wood famine in the country. In spite of our limited wood resources, 50% of domestic energy requirements are met by fuelwood. It is further estimated that an other 16% are met by fossil fuels and the remaining 34% by dung and crop residues. It would not be out of place to mention that at present our households use kerosine oil worth 2.4 billion rupees annually of which two-third is imported. Prices of constructional timber and fuelwood have registered an alarming increase during the last few years. The country's 94.64 million people are going to be more than 150 million by the turn of the century. Their current annual demand of fuelwood of 19 million m³ would also increase with the same rate, if not faster due to better standard of living, higher literacy rates, etc. to 30 million m³ in the year 2000. (Sheikh 1987).

Out of many alternatives and measures which can be taken to bridge this gap between supply and demand like putting more area under state forests, intensifying the forest management practices for better yields per unit of area, economizing on the use of wood by improving

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stove technology, planting trees on farmers lands and other waste lands, using such fast growing fuelwood species which could grow in semi-arid and marginal lands without any difficulty, it is this last possibility which this paper intends to advocate here.

Main Attributes and Environmental Requirements of Mesquite

Mesquite (*Prosopis juliflora*) commonly known as *Kabuli* kikar, vilayati babool or pahari kikar or even as mesquite is a highly esteemed fuelwood source in many parts of Pakistan and it is also valued for the shade and forage it can provide. It is native to central America and northern South America and was introduced into Indo-Pak sub-continent over 100 years ago (NAS, 1980), planted for stabilizing dunes and for fuel. It has now spread throughout Pakistan.

This species grows in very warm, dry climates and can tolerate heat and drought. The tree is found growing from sea level to 1500 m. It grows in areas with an annual rainfall of 150–750 mm. The plants roots penetrate to great depths in search of soil moisture. The tree can grow on a variety of soils including sandy, saline, rocky slopes and sand dunes. Mesquite reproduces easily by root suckers and seeds and the trees coppice readily (NAS, 1980). It with stands annual coppicing right from the second year of planting (Tiwari, 1983).

The species grows fast. Its wood is hard and heavy (specific gravity, 0.70 or higher). It is excellent for firewood and makes superior charcoal. It burns slowly and evenly and holds heat well. The wood is very durable and is used for fence posts, door and window frames, and other light carpentry. The flowers are a valuable source of nectar for high quality honey. The pods are eaten by livestock and may also be ground into flour for human consumption (NAS, 1980). In Pakistan, mainly its bushy variety is found which is used as firewood and for making inferior type of furniture and the pods are eaten by livestock which disseminate its seed through their droppings.

Existing State of Mesquite

This species has spread like a weed in irrigated forest plantations and is also occupying a handsome area on bare lands around habitations and along roads, canalsides and railway tracks and other waste lands. It is considered a big nuisance by the forest departments and a substantial amount of funds, time and planning efforts of the professional foresters is taken away by mesquite for its eradication from forest plantations and from new afforestation sites. In spite of best efforts of the foresters, within the financial resources available, it has not been possible to eradicate it from the forest areas, rather it is increasing at a rapid rate and constitutes the major portion of growing stock in some of the once valuable forest plantations.

Mesquite, growing on vacant lands around villages and along roads, canals and railways, serves as a source of free fuelwood for the rural people in many parts of Pakistan. This species has been coming in naturally in blank, failed or sparsely stocked forest areas and providing at least fuelwood to harvest. It is worth mentioning here that, but for the availability of this species as fuelwood, our existing forests/plantations would have suffered much severe degrada-

tion at the hands of fuelwood collectors and fuelwood prices would have sky rocketed in our country. The price situation, though, even now is quite threatening.

Let us Reconcile with Mesquite

Keeping in view the results of foresters' efforts for eradication of this species from plantations, inadequate supply of irrigation water to raise better species in irrigated plantations and the silent fuelwood crisis of the country (like other developing countries), it looks surprising that why despite its very fast growth and hardiness, high coppicing power, nitrogen fixing ability (Felker and Clark, 1980), excellent burning quality of its wood, this species is not being raised systematically in plantations to satisfy the country's basic fuel needs. Mesquite (*Prosopis juliflora*) is an excellent candidate for energy plantation particularly in semi-arid and marginal lands where other more valuable forest species cannot be successfully grown. It should be possible to allocate those areas of our forest plantations to this species where better species like Shisham (*Dalbergia sissoo*), Kikar (*Acacia nilotica*), Mulberry (*Morus alba*), Phulai (*Acacia modesta*) etc. cannot be grown. It is desirable now, after nearly 40 years of estrangement, to reconcile with mesquite and make the best use of its attributes and hardiness for solving the critical firewood shortage problem.

Biomass Production

The biomass production by *Prosopis juliflora* has been studied experimentally in India alongwith other species (like *Eucalyptus hybrid*, *Albizia lebbek*, *Dalbergia sissoo*, *Acacia nilotica*, *A. tortilis* and *Cassia siamea*). Mesquite planted over one hectare at 1.3m x 1.3m spacing in Gujrat State, where annual rainfall is 700mm and average annual temperature is 30°C, produced at 18,24,30,36 and 48 months age a total biomass of 19.69, 41.39, 69.11, 114.62 and 148.63 dry tons per ha respectively. The corresponding figures for utilizable biomass (wood, bark and branch) were 14.63, 32.17, 50.59, 88.87 and 113.25 dry tons per ha. (Gurumurti, Raturi, et al, 1984). These results show that *Prosopis juliflora* is an exceptionally higher yielder which is evident from the fact that over 19 dry tonnes of total biomass per hectare was produced by this species at the age of 18 months which was significantly higher compared with that of *Eucalyptus* at the same age and similar conditions, the total value for the latter being 13.6 dry tonnes (Gurumurti, et al, 1984).

Branch component constituted the major portion of total biomass being around 50–55% at all ages. Utilizable biomass was three fourth of total biomass at all ages (Gurumurti, Raturi, et al, 1984). This quality of enormous branch biomass production coupled with the capacity of *Prosopis juliflora* to coppice profusely can be adequately exploited for developing net work of fuelwood plantations in the country. As already mentioned, the wood of this species is hard and heavy, burns slowly and evenly and holds heat well (NAS, 1980). Another interesting quality of this species is that, nearly 75% of the biomass produced is utilizable in nature right from the early age. In fact, the utilizable biomass produced by this species at the 48 months is 113 dry tonnes per hectare which works out to little over 28 dt/ha/year; the total biomass

produced being 148 dt/ha. It is thus an excellent candidate for short spacing short rotation forestry particularly for meeting the fuelwood demand in Pakistan.

The solar energy conversion efficiency by *Prosopis* was found to range between 0.59% at 18 months to 1.68% at 48 months with a peak value of 1.87% at 36 months (Gurumurti, Raturi, et al, 1984). Szego and Kemp (1973) state that plantations with 0.7% conversion efficiency (14 dt/ha/yr) would be sufficient to make energy forestry an economic and successful proposition. However, Inman (1977) and Gibson (1978) have fixed the projected yield to be around 25 dt/ha/year for economic feasibility of energy plantations. The high yield of 113 dt of utilizable biomass (or 148 dt of total biomass) per ha at the age of 4 years has been achieved in semi-arid non irrigated conditions. There is considerable variation among the population of trees, and appropriate selection and breeding process should produce genetic stock which can yield more biomass. The variables diameter and height can be used to reliably predict the biomass production in *Prosopis juliflora* with the help of regression equations (Gurumurti, Raturi, et al, 1984). It is possible to improve the biomass production per unit of time and area through energy plantation practices even with the presently available genetic materials.

To conclude it may be said that *Prosopis juliflora* is an ideal candidate for energy plantations in semi-arid and marginal lands, not only to meet the fuelwood demands but also to improve the said fertility because this plant is fast growing, hardy and nitrogen fixing leguminous tree. We, the foresters, should change our hostile attitude towards mesquite and develop amicable terms with it to direct its aggressiveness towards our benefit.

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