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**Presenter Information**

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## **Performance of *Acacia senegal* L.: Untapped wealth of gum Arabic in rangelands and grasslands in arid and semi arid region of India**

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### **Introduction**

*Acacia senegal* (Linn) Wild a member of Mimosaceae is a small tree of 3-6m in height with umbrella-shaped crown. It is a typical tree of Sahel in Africa from Senegal to red sea and essentially limited to the area between 11<sup>0</sup> and 16<sup>0</sup> North, with a wide range of rainfall 100 to 800mm. It spread widely in tropical Africa from Mozambique, Zambia to Somalia, Sudan, Ethiopia, Kenya, Tanzania and Nigeria, and in South Asia in India and Pakistan. In India it is a typical tree of arid regions with a low rainfall of 100-250mm. It is drought resistant and tolerates prolonged dry period of 10-11 months, with maximum temperature reaching 50<sup>0</sup>C with strong winds, but susceptible to frost. It occurs mostly on sand stones and skeletal soils and widely distributed as interspersed species in most of the rangelands and grasslands in arid and semi-arid regions of India. World's 90% gum Arabic is produced from *Acacia senegal*. The quality of gum is very superior as compared to gum from any other species of *Acacia* (Andreson, 1990). Nearly 90% of gum Arabic is produced by Republic of Sudan especially from (Kordafan). Production of gum Arabic is meagre in India, and contribution to the world production is negligible. The total annual output of gum Arabic is only 800 Mt compared to world production and consumption of 60,000-70,000 Mt. The domestic production is insufficient even for domestic consumption and more of it is imported from Sudan and Nigeria to meet India's requirements. Gum exudes from cracks in bark of trees, mostly in the dry season. In Sudan the annual yields from young trees ranges from 188 to 2856 g (av. 0.9 kg), and from older trees, 379 to 6754 g (av. 2.0 kg). In India, however, the productivity is low varying from 175 to 550g tree<sup>-1</sup> year<sup>-1</sup>. The main gum producing regions of India where natural as well as planted stands of *A. senegal* occur are in desert and arid region of Rajasthan, Gujarat, Haryana, and Punjab. The gum yield from various *Acacia* trees in their natural habitat is very poor.

In arid and semi-arid region of India, particularly in Rajasthan, Gujarat, Haryana, Punjab and Bundelkhand, there is a good scope for extending area for large- scale plantation for production of gum Arabic. The area covered under forest, barren and uncultivable, pasture, *oren* (temple lands) and community grazing land etc, can be used for commercial plantation of *A. senegal*. The arid zone of Western Rajasthan is prone to frequent drought and famine and cultivation of gum Arabic can provide livelihood security to desert dwellers. A farmer who has planted 100 trees/ ha at spacing of 10 x 10 m can harvest about 25kg gum assuming average yield of 250g per tree. This would generate revenue of Rs 10000 ha<sup>-1</sup> year<sup>-1</sup> if, gum is sold at a minimum price of Rs. 400 kg<sup>-1</sup>. In addition, systematic commercial plantation of *Acacia senegal* can also provide employment to millions of people towards various planting activities and gum collection. According to an estimate of FAO, gum collection sustains about 0.3 million people and has huge potential of employment

Integration of *Acacia senegal* in traditional grazing grounds such as *orens* and *gochars*, systematically raised silvopastoral systems and other agroforestry landuse for production of gum Arabic can be a profitable proposition. It will not only provide alternative livelihood options to local people but also increase economic viability and sustainability grasslands and pastures. In consideration of wide variations in gum production in respect to sites, annual rainfall and geographical locations, it imperative to study growth performance of *A. senegal* in different eco-regions and develop site specific models for optimizing production of gum Arabic. This study is a part of research efforts being made at Central Agroforestry Research Institute, Jhansi, which is one of the co-ordinating centres in the ICAR-network project on Natural Resin and Gums headquartered at Indian Institute of Natural Resin and Gums, Ranchi. The main objective is to develop suitable agroforestry models based on gums and resins yielding trees for Bundelkhand region. This paper presents growth performance of *A. senegal* in semi-arid region of Bundelkhand, Central India.

### **Materials and Methods**

The study was conducted at ICAR-Central Agroforestry Research Institute (CAFRI), Jhansi (24<sup>0</sup> 11' N- 78<sup>0</sup> 17' E and 271 m above msl). On agro-ecological zone map of India, Jhansi lies in agro-ecoregion 4 [Northern Plain and Central Highlands, Hot Semi Arid Eco-region with Alluvium-derived soil (Sehgal *et al.*, 1990). Mean annual rainfall is 960 mm with an average of 52 rainy days per year. Mean maximum temperature ranges from 47.4<sup>0</sup>C (June) to 23.5<sup>0</sup>C (January)

and mean minimum temperature from 27.2<sup>0</sup>C (June) to 4.1<sup>0</sup>C (December). The main soil types in the region are red (Alfisol) and black (Vertisol). Red soils occur at elevated spots are shallow, gravelly and light textured, pH varies from 6.08 to 6.70 and organic carbon varies from 0.38% to 0.65%. Black soils are situated in comparatively low lying areas and are fine textured, highly water retentive, pH varies from 5.70 to 6.78 and organic carbon varies from 0.41% to 0.67%.

*Acacia senegal* was planted in six agroforestry models (3 at research farm and 2 at farmer's field) in 2009. The models represent either agri-horti-silviculture or horti-silviculture system of agroforestry. The horticulture species were *Emblia officinalis* (Anola), *Citrus limon* (Lemon), *Aegle marmelos* (Beal) and *Carrissa carandus* (Karonda). In these models, *A. senegal* is planted either on boundary or as row plantation. One block plantation of *Acacia senegal* was also done at research farm. The growth of *A. senegal* has been evaluated for variation in plant height and collar diameter and exudation of gum at various sites in different models.

## Results and Discussion

Survival of *A. senegal* varied from 86 to 96% in agroforestry models established at research farm while from 54 to 78% on farmers field. Plant height, girth at breast height (gbh) and canopy of trees respectively ranged from 3.28 to 4.59m, 9.2 to 26.0cm, and 7.1 to 16.5m<sup>2</sup> in models raised at research farm. The respective values on farmers' field varied from 2.3 to 3.5m, 6.1 to 22.5cm and 3.4 to 6.4m<sup>2</sup>. Oozing of gum has not been observed in any model either on research farm or on farmers' field. In general, survival and growth performance of *A. senegal* was better in agroforestry models raised at research farm than that on farmers field. Comparatively lesser survival and growth in terms of plant height, gbh and canopy on farmers field than on research farm appears to be due to grazing hazards to saplings as *anna pratha* is practised in the region. In *anna pratha* the cattle are let loose, which openly graze and trembles growing saplings planted on farmers' fields. The planted seedlings require to be protected from moving cattle in beginning for 2-3 years. Findings also revealed that *A. senegal* performed better in semi- arid region of Bundelkhand than arid region of western Rajasthan wherein after 12 years of age plants reported to attain height of about 3.0m on rocky and gravelly soil (Mertia, 2007. Personal communication).

## Conclusion

Results indicate that growth of *A. senegal* is very good in semi-arid region of Bundelkhand, Central India and plantation expected to yield good quantum of gum. To raise commercial plantation for higher gum production, quality planting stock should be planted at proper spacing depending on site conditions and type of plantation stands aimed. Further studies are required on management of soil and plant nutrition for equilibration of energy to harness maximum gum productivity from commercial plantations.

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