

## Diversity, Oil Yield and Economic Significance of Oil-Bearing Plant Species in India

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### Abstract

*The present study examines the diversity of oil-bearing plant species in India with emphasis on their oil yield potential and economic importance. Using the secondary data of botanical, agronomic, and economic research, the paper compares the significant cultivated oilseeds and tree-bearing oil plants. The analysis shows that interspecific difference is high in terms of oil content, yield efficiency, and end-use applications, and that includes edible oils and industrial and bioenergy applications. The paper identifies the importance of the diverse diversity of oil-bearing plants in the maintenance of the rural livelihoods, industrial growth, and viable use of oil resources that are produced out of plants.*

**Keywords:** Oil-bearing Plants; Oilseed Crops; Tree-borne Oilseeds; Oil Yield; Economic Importance; Plant Resources; India

### Introduction

The species of oil-bearing plants form an important part of the agriculture economy and industry development of India. Plant oil is highly utilized in the edible industry, traditional medicine, cosmetics, pharmaceuticals, soaps, lubricants, and paints, as well as bio-based industrial products. The various agro-climatic regions in India produce a wide variety of oily vegetation comprising annuals, perennials, shrubs, and species in the wild. Their production and use are a significant source of rural livelihood, agricultural-based industries, and economic development in the country (Weiss 2000; Gunstone 2011).

The vegetable oil market in India relies on such edible oilseeds as groundnut, mustard, sesame, sunflower, soybean, and coconut. Besides these large crops, there are also a number of minor and nonconventional oil-bearing species that are critical at regional and local levels. The oilseeds growing on trees, such as *Azadirachta indica*, *Madhuca longifolia*, *Pongamia pinnata*, and *Jatropha curas*, are particularly important in the rainfed and marginal regions where traditional farming is limited. These species are not only the source of oil but also help increase the stability of the ecological environment by conserving the soil and adapting to the conditions of unfavorable environments (Hegde 2003; Kaushik et al. 2007).

There is a wide range of oil yields and the qualities of the plant species because of genetic composition, environmental factors, agricultural processes, and treatment procedures. The content of oils, composition of fatty acids, and performance during extraction are some of the variables that establish the end use that a species is suitable to be used in. Even though edible oils have been used

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due to their nutritive quality, non-edible oils continue to gain importance in terms of their industrial use, such as in the production of biodiesel and biolubricants. Oil yield and composition are also scientifically determined parameters required in order to optimize the utilization of resources and find economically viable species (Gunstone 2011; Makkar et al. 2009).

In addition to having an agronomic and industrial use, oil-bearing plants are of significant socio-economic importance in India. Growing, harvesting, processing, and selling oilseeds provide jobs in the rural and semi-urban regions. Several agroforestry systems, which use tree-borne oilseeds, are closely tied to the local economies and traditional activities. The need to promote such species has been advanced as a way of improving income security, especially for the small and marginal farmers (Hegde 2003).

With these issues, India is still faced with the problems of low oilseed production, heavy reliance on imports, and failure in the use of the native oil-bearing plant diversity. Climate changes and studies have thus seen the focus on diversification of oilseeds, yield potential, and added value through increased processing and market integration. Comparative evaluation of oil-bearing species using documentation and comparative assessment in relation to the aspects of diversity, oil production, and economic interest are significant milestones towards these ends (Weiss 2000).

In this regard, the overall study of the oil-bearing plant species in India is rather important. Through a combination of current understanding of animal diversity, oil production potential, and value, the research will attempt to give a combined view of plant-based oil resources. The result of such an evaluation can be used to guide future studies, facilitate strategies of sustainable utilization, and further enhance the capacity of the Indian oilseed industry.

### **Objectives**

- To document the diversity of major oil-bearing plant species occurring in India.
- To examine variations in oil yield among selected oil-bearing plants.
- To assess the economic significance of oil-bearing plant species in the Indian con

### **Research Methodology**

The present study is based on secondary data compiled from peer-reviewed research articles, standard textbooks on the oilseed crops, government and institutional reports, and botanical literature on the oil-producing plant species in India. Data on species diversity, oil production, and economic applications were searched and gathered in a logical and effective manner and by using trustworthy academic resources. An analytical/comparative and a descriptive model were used to examine differences in oil content, yield, and/or economic relevance of selected species. The use of standard botanical nomenclature and accepted classification was provided as well in order to guarantee precision and uniformity in the interpretation of data.

### **Literature Review**

Plant species that bear oils have received long-term scientific interest on grounds of their nutritional,

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industrial, and economic value. Initial research in the oilseed crops focused on the variety of plant sources involved in edible and non-edible oils and also the impact of species-specific attributes on the yield and quality of oil (Weiss, 2000). This view was later extended by other studies that incorporated agronomic, biochemical, and economic aspects to assess oil-bearing plants as policy resources in emerging economies like India (Gunstone, 2011).

The oilseed industry in India is typified by an amalgamation of both large-scale crops and an array of less important and tree-bearing oilseed species. Domestic edible oil, including various major annual oil-bearing crops, such as groundnut (*Arachis hypogaea*), mustard (*Brassica juncea*), sesame (*Sesamum indicum*), sunflower (*Helianthus annuus*), and soybean (*Glycine max*), occupies a significant portion of the domestic product. Reported studies have also indicated that oil levels in these crops have a lot of variability due to variations in varietal differences, climate, and exerted management practices (Hegde, 2003). The yield gaps are a long-standing issue in spite of the fact that the technology of production has been improved.

Alongside the regular oilseeds, the non-traditional oil-bearing plants as well as plant-trees are gaining increased significance in India. These species, e.g., *Cocos nucifera*, *Elaeis guineensis*, *Azadirachta indica*, *Madhuca longifolia*, *Pongamia pinnata*, and *Jatropha curcas*, are highly discussed in the literature due to the presence of high oil content and their multipurpose use. The studies on the tree-borne oilseeds have highlighted their flexibility to marginal land and potential in rural livelihoods and energy security (Kaushik et al., 2007; Makkar et al., 2009).

The yield of oil, which is one of the foremost parameters in the assessment of oil-bearing plants, differs greatly even within different species. An example of this is oil palm (*Elaeis guineensis*), which is known to have an extremely high rate of oil yield per hectare, and such crops like sesame or mustard have moderate yields but good-quality oil endowed with proven dietary benefits. Research has also pointed out that tree species like *Pongamia pinnata* and *Madhuca longifolia* give lower yields compared to the palm oil but they have ecological and socio-economic benefits as they can be integrated into any agroforestry systems and they require low input levels (Gunstone, 2011).

The economic impact of plants that produce oil does not end with oil mining. Some research has indicated that the by-products like oilcakes, husks, and biomass remnants are good animal feeds, organic manure sources, and sources of energy. Further, *Jatropha curcas* and *Azadirachta indica* have been considered in the production of non-edible oils that could be used in the production of biodiesel and industries, a move that can be termed as a diversification of the market (Makkar et al., 2009). With this diversification, the economic value of oil-holding plants will be increased.

In order to integrate the data on diversity, oil yield, and economic significance, the data on the species of oil-bearing plants that are frequently found in India are condensed in Table 1. The table emphasizes big cultivated species and tree-borne crops, their potential in the oil yield, and the main economical applications.

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| Botanical name                                    | Plant type  | Approximate oil content / yield | Major economic uses            |
|---|-------------|---------------------------------|--------------------------------|
| <i>Arachis hypogaea</i> L.                        | Annual crop | 45–50% seed oil                 | Edible oil, confectionery      |
| <i>Brassica juncea</i> (L.) Czern.                | Annual crop | 35–40% seed oil                 | Edible oil, condiments         |
| <i>Sesamum indicum</i> L.                         | Annual crop | 45–55% seed oil                 | Edible oil, pharmaceuticals    |
| <i>Glycine max</i> (L.) Merr.                     | Annual crop | 18–22% seed oil                 | Edible oil, animal feed        |
| <i>Helianthus annuus</i> L.                       | Annual crop | 35–45% seed oil                 | Edible oil, industrial uses    |
| <i>Cocos nucifera</i> L.                          | Tree        | 60–65% copra oil                | Edible oil, cosmetics          |
| <i>Elaeis guineensis</i> Jacq.                    | Tree        | High oil yield per ha           | Edible oil, industrial uses    |
| <i>Madhuca longifolia</i> (J. Koenig) J.F. Macbr. | Tree        | 35–40% seed oil                 | Edible oil, soap industry      |
| <i>Pongamia pinnata</i> (L.) Pierre               | Tree        | 30–40% seed oil                 | Biodiesel, medicinal uses      |
| <i>Azadirachta indica</i> A. Juss.                | Tree        | 25–30% seed oil                 | Biopesticides, pharmaceuticals |

**Table 1. Major oil-bearing plant species of India, oil yield, and economic significance**

### Conclusion

The current paper brings out the high diversity of oil-bearing plant species in India and emphasizes the fact that most of them have great oil yield potential and economical value. The literature also suggests that though the oil is mainly produced by major oilseed crops, non-traditional and tree-bearing oil crops have a great contribution to rural livelihoods, industrial uses, and diversification of resources. Relative analysis shows that species vary significantly in yield efficiency and final use worth. The study achieves its goals by combining the available knowledge and by highlighting the importance of the combined efforts, which would increase the productivity and the sustainability of the oil-bearing vegetation resources in India.

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