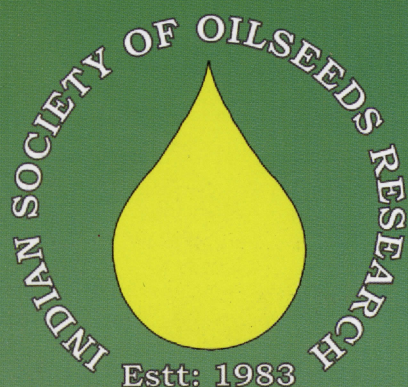


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# Rice bran oil, a hitherto untapped source to meet the edible oil deficit in India

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## ABSTRACT

India is the world's fourth largest edible oil producer, it is the world's leading importer and consumer of edible oils in the world. The annual *per capita* consumption of edible oil in the country shot up from around 3 kg in 1950 to 15.9 kg during 2015-16. The continued demand for edible oils by the ever increasing population makes edible oil deficit as a perennial national problem. Therefore, it is pertinent to explore new, unconventional edible oil sources to meet country's ever growing edible oil demands. Of several available options, rice bran oil has potential to jazz up the edible oil deficit, thus making India self-sufficient. Nutritional and toxicological evaluations of rice bran oil proved that this is a healthier option and an attempt has been made in this direction to assess the available untapped rice bran oil reserves at state and county level for rapidly filling up the edible oil supply-demand deficit.

**Keywords:** Edible oil deficit, Production, Rice bran oil, Vegetable oils

With 21 per cent of the world's area and 15 per cent of world's production, India is the fourth largest oilseed producing country in the world, next to the USA, China and Brazil. Oilseeds in India account for the second largest agricultural commodities after cereals, sharing 13 per cent of the country's gross cropped area, nearly 5 per cent of gross national product and 10 per cent of the value of all agricultural products (Hedge, 2009). The diverse agro-ecological conditions in the country are favourable for growing all the nine annual oilseeds, which include seven edible oilseeds viz., groundnut (*Arachis hypogaea*), rapeseed (*Brassica napus*), mustard (*Brassica juncea*), soybean (*Glycine max*), sunflower (*Helianthus annuus*), sesame (*Sesamum indicum*), safflower (*Carthamus tinctorius*) and niger (*Guizotia abyssinica*), and two non-edible oilseeds viz., castor (*Ricinus communis*) and linseed (*Linum usitatissimum*). Apart from annual oilseeds, a wide range of perennial tropical oil crops of horticulture origin including in particular coconut (*Cocos nucifera*) and oilpalm (*Elaeis guineensis*) are also cultivated in the country. In addition, substantial quantity of vegetable oils is also obtained from non-conventional sources viz., ricebran, cotton seed, corn and tobacco seed (Hedge, 2012).

India is the world's leading importer and consumer of edible oils in the world (Table 1). India currently plays an important role in the global edible oil market, accounting for ~11 per cent share of consumption; 7 per cent share of oilseed production; 5 per cent share of edible oil production and 14 per cent share of world edible oil imports. The *per capita* consumption of edible (= vegetable oils) in the country shot up from around 3 kg annually in 1950 to 15.9 kg during 2015-16 (ICRA, 2015). This increasing trend of edible oil demand has begun to ring alarm bells owing to its

severe health implications in the form of a rising tide of cardiovascular complications. Further, experts also fear shortages in the future if the consumption continues to grow at the current pace. Therefore, the present scenario calls for some urgent measures to be taken to step-up edible oil production on a sustainable basis for the growth in oilseeds production has not kept pace with their increasing domestic demand. Thus, intensifying the use of land also seem to be a feasible option, if there are limited chances of area expansion under oilseed crops (Jha *et al.*, 2012). Under these circumstances, exploiting the other alternative, non-conventional edible oil sources will provide realistic options to meet the country's vast supply-demand deficit in the edible oil sector. Of several alternative non-conventional edible oil sources, rice bran oil, a byproduct of rice (staple food for a large part of the world's human population, especially in Asia) offers potential solution that could sustainably close the edible oil gap.

Table 1 Domestic edible oil production and imports (in lakh tonnes)

Year	Production of edible oils	Imports
2005-2006	83.16	40.91
2006-2007	73.70	46.05
2007-2008	86.54	54.34
2008-2009	84.56	74.98
2009-2010	79.46	74.64
2010-2011	97.82	72.42
2011-2012	89.57	99.43
2012-2013	92.19	106.05
2013-2014	100.80	109.76
2014-2015	89.78	127.31

Source: Department of Food & Public Distribution  
(<http://dfpd.nic.in/oil-division.htm#>)

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Rice Bran Oil (RBO) is an excellent substitute for vegetable oil. This oil is notable for its high smoke point of 232°C (450°F) and its mild flavour, making it suitable for high-temperature cooking methods such as stir frying and deep frying and popular as a cooking oil in several Asian countries, including Bangladesh, Japan, India and China ([www.wiki/ricebranoil](http://www.wiki/ricebranoil)). The viscosity of RBO is very light and food cooked with RBO absorbs up to 15 to 20 per cent less oil ([ricela.com](http://ricela.com)). It's not just delicate and flavorful, it can help lower cholesterol, fight diseases, enhance the immune system, fight free radicals and more ([niir.org](http://niir.org)).

RBO is unique among edible oil due to its rich source of commercially and nutritionally important phytochemicals such as oryzanol, lecithin, tocopherols and tocotrinols. However, most of these phytochemicals are removed from the RBO as waste byproducts during the refining process.  $\gamma$ -oryzanol is one of such component having the potential to be used in nutraceutical, pharmaceutical and cosmoceutical preparations. It is a mixture of ferulic acid esters of sterol and triterpene alcohols and occurs at a level of 1-2 per cent where it serves as natural antioxidant (Patel *et al.*, 2004). Globally, the RBO is very popular and called as 'Heart Oil' in Japan and is being sold as 'World's Healthiest Oil' in the USA. In Europe, RBO has acquired the status of 'Functional Food' and it is also accepted as a 'Premium Cooking Oil' in Japan, Thailand and in India.

RBO, a byproduct of rice is actually the oil extracted from rice bran-the outer layer of rice kernels. Rice bran refers to the thin coating removed from the brown rice during the process of milling. Rice bran removed during milling is about 7.5 to 8 per cent. Rice bran contains anything between 15 to 20 per cent oil depending on the rice variety and the milling process utilized (Atul Chaturvedi, 2013).

Rice, the initial raw material for RBO is grown in more than a hundred countries, with a total harvested area of approximately 158 million hectares, producing more than 700 million tonnes annually. Rice being the major food crop in Asia nearly 90 per cent of the world's rice is produced and consumed in this region ([fao.org](http://fao.org)). Nearly 640 million tonnes of rice is grown in Asia, representing 90 per cent of global production ([ricepedia.org](http://ricepedia.org)). Today, the world's largest rice producers are from Asian countries and the majority of all rice produced comes from China and India followed by Indonesia, Bangladesh, Vietnam, Thailand, Philippines etc. ([www.wikipedia.org](http://www.wikipedia.org)) (Fig. 1).

India is among the leading rice producers in the world and stand at 2<sup>nd</sup> position in the world. Apart from being the leading rice producer, India is also the largest exporter of rice in the world and in the last financial year, India exported more than 8 million tonnes of rice to many countries. Rice is grown widely across the nation in more than 20 states and in an area of over 400 lakh hectares. Out of these states, top 10 rice producing states accounts for more than 80 per cent of total rice production in India (Fig. 2). West Bengal is the

leader among all rice producing states with more than 13 per cent contribution in India's rice production with 146.05 lakh tonnes (Fig. 3). Rice is grown in a large area in West Bengal in more than 50 lakh hectares of land, which is about 50 per cent of total cultivated land of the state. In terms of yield, Tamil Nadu stands on top with yields of more than 3,900 kg per hectare ([listz.in](http://listz.in)).

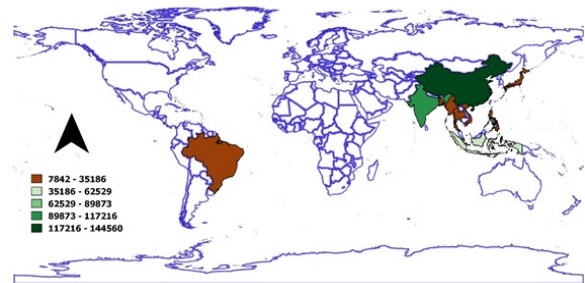


Fig. 1. Top ten rice producing countries in the world

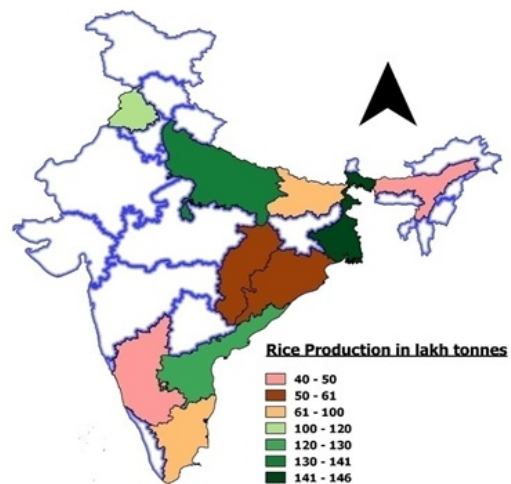


Fig. 2. Top ten rice producing states

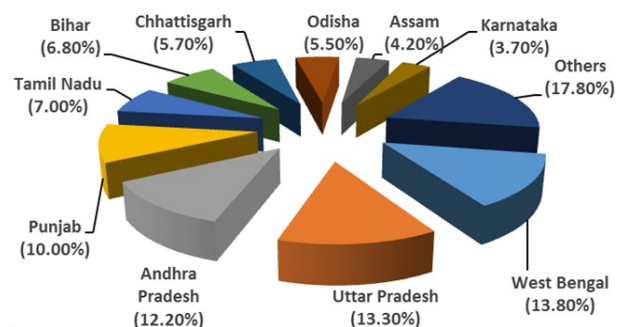


Fig. 3. State-wise contribution of rice production

## RICE BRAN OIL, A HITHERTO UNTAPPED SOURCE TO MEET THE EDIBLE OIL DEFICIT IN INDIA

Rice has been cultivated several years in India and there is a tremendous growth rate in terms of production. During 1950-51 there was 20.58 million tonnes production and as today we crossed more than 100 million tonnes (Fig. 4). The major contribution comes from West Bengal (13.8%) followed by Uttar Pradesh (13.3%), Andhra Pradesh (12.2%), Punjab (10.0%), Tamil Nadu (7.0%), Bihar (6.8%), Chhattisgarh (5.7%), Odisha (5.5%), Assam (4.2%), Karnataka (3.7%) and other states are contributing around 17.8 per cent of the country's rice production.

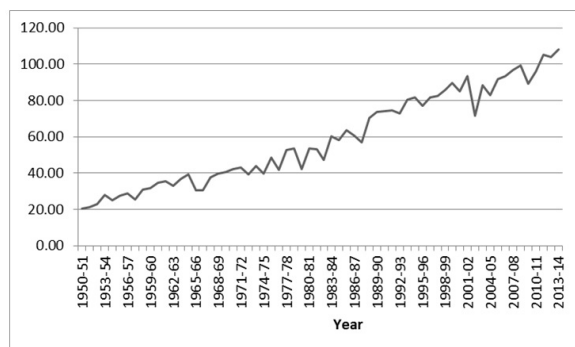


Fig.4. Rice production (million tonnes) trend from 1950-51 to 2013-14

The current potential of RBO in the world is 3.5 million tons, against which the current production is only about 1.5 million tonnes. The major producers are India (9,50,000 T), China (2,00,000 T), Japan (80,000 T) and Thailand (50,000 T). India represents nearly 2/3<sup>rd</sup> of the world production and is number one in the world. Last one decade, India RBO production increased from 0.68 to 0.93 million tonnes. But in India potential for RBO production is 1.61 million tonnes. Current production is 0.93 million tonnes. This leaves an unrealized potential of 0.68 million tonnes (Table 2). In fact, last one-decade, there is an increasing trend can be seen in RBO production in India, which around 5 per cent of average growth rate except in the year 2009-10. At the same time, un-utilized potential RBO is more than 57 per cent.

Table 2 RBO Production, potential and untapped RBO (quantity in million tonnes)

Year	RBO Production	RBO Potential	Untapped RBO
2004-05	0.68	1.28	0.60
2005-06	0.73	1.40	0.67
2006-07	0.75	1.43	0.68
2007-08	0.80	1.40	0.60
2008-09	0.85	1.51	0.66
2009-10	0.80	1.36	0.56
2010-11	0.83	1.45	0.62
2011-12	0.88	1.52	0.64
2012-13	0.90	1.58	0.68
2013-14	0.93	1.61	0.68

Source: <http://seaofindia.com/cdn/gallery/2409.pdf>

As per the rice production data in the country during 2013-14, state-wise potential RBO was calculated and presented in Table 3. West Bengal was leading with 0.21 MT of potential RBO followed by Uttar Pradesh (0.20 MT), Andhra Pradesh (0.19 MT), Punjab (0.15 MT), Tamil Nadu (0.11 MT), Bihar (0.10 MT), Chhattisgarh (0.09 MT), Odisha (0.08 MT), Assam (0.06 MT), Karnataka (0.06 MT) and other states contribution was around 0.27 MT. But during 2013-14 RBO production in India was around 0.93 MT and untapped RBO was around 0.68 MT.

India is expected to produce rice about 125 and 160 MT by 2025 and 2050 respectively, and which has the potential to yield 1.80 and 2.30 MT of RBO ([www.taas.in](http://www.taas.in)) (Table 3). The projections are based on the assumptions that the per capita consumption would be increasing annually at 3 per cent till 2013-14, followed by an increase in a declining rate of 2.5 per cent from 2013-14 to 1.75 per cent in 2025, with a further decline in the incremental consumption to negligible levels by the year 2050. The estimated per capita consumption is accordingly placed at 17.50 and 19.16 kg/annum in the year 2025 and 2050, respectively. The total edible oil requirement is estimated at 24.50 and 32.19 MT during 2025 and 2050 respectively (Table 4).

Table 3 State-wise potential RBO production (2013-14) (quantity in million tonnes)

State	Rice Production	RBO Potential
West Bengal	14.90	0.21
Uttar Pradesh	14.36	0.20
Andhra Pradesh	13.18	0.19
Punjab	10.80	0.15
Tamil Nadu	7.56	0.11
Bihar	7.34	0.10
Chhattisgarh	6.16	0.09
Odisha	5.94	0.08
Assam	4.54	0.06
Karnataka	4.00	0.06
Others	19.22	0.27

Source: Directorate of Economics and Statistics

Table 4 Projection of rice and RBO for year 2025 and 2050 (quantity in million tonnes)

	Year		
	2013-14	2025	2050
Rice	108	125	160
RBO Potential	1.61	1.80	2.30
Population (billion)	1.25	1.40	1.68
Per capita consumption (kg/annum)	14.40	17.50	19.16
Edible oil requirement	18.00	24.50	32.19

Projected values based on the study



Based on the historical data growth rates, state-wise rice production is predicted for West Bengal which is leading with 17.25 and 22.07 MT followed by Uttar Pradesh (16.62 and 21.27 MT), Andhra Pradesh (15.25 and 19.53 MT), Punjab (12.50 and 16.00 MT), Tamil Nadu (8.75 and 11.20 MT), Bihar (8.50 and 10.87 MT), Chhattisgarh (7.13 and 9.13 MT), Odisha (6.88 and 8.80 MT), Assam (5.25 and 6.73 MT), Karnataka (4.63 and 5.93 MT) and others states contribution will be around 22.25 and 28.47 MT for the year 2025 and 2050, respectively. According to rice production estimations, state-wise potential RBO is estimated and presented in Table 5. West Bengal is leading with 0.25 and 0.32 MT followed by Uttar Pradesh (0.24 and 0.31 MT), Andhra Pradesh (0.22 and 0.28 MT), Punjab (0.18 and 0.23 MT), Tamil Nadu (0.13 and 0.16 MT), Bihar (0.12 and 0.16

MT), Chhattisgarh (0.10 and 0.13 MT), Odisha (0.10 and 0.13 MT), Assam (0.08 and 0.10 MT), Karnataka (0.07 and 0.09 MT) and other states contribution will be around 0.32 and 0.41 MT for the year 2025 and 2050, respectively.

India is one of the world's largest producers of oilseeds and consumers of edible vegetable oil, producing around 8.2 million tonnes and importing around 11 million tonnes annually to meet domestic demand. In this context, the growing popularity of rice bran oil in the country is a welcome development for the government, which is keen to reduce dependency on edible oil imports. It also provides an incentive to boost rice farming in the country. The health benefits associated with the consumption of rice bran oil will be a boon to promote its production and popularize its consumption nationwide.

Table 5 State-wise projection of RBO for year 2025 and 2050 (quantity in million tonnes)

State	2025		2050	
	Rice Production	RBO Potential	Rice Production	RBO Potential
West Bengal	17.25	0.25	22.07	0.32
Uttar Pradesh	16.62	0.24	21.27	0.31
Andhra Pradesh	15.25	0.22	19.53	0.28
Punjab	12.50	0.18	16.00	0.23
Tamil Nadu	8.75	0.13	11.20	0.16
Bihar	8.50	0.12	10.87	0.16
Chhattisgarh	7.13	0.10	9.13	0.13
Odisha	6.88	0.10	8.80	0.13
Assam	5.25	0.08	6.73	0.10
Karnataka	4.63	0.07	5.93	0.09
Others	22.25	0.32	28.47	0.41

Projected values based on the study

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