

MEDICO-NUTRITIONAL VALUE AND PROFITABILITY OF BLACK RICE- THE NEW BLACK GOLD OF INDIAN AGRICULTURE

Article Id: AL2021165

¹Rajarshi Banerjee*, ²Ananya Chakraborty, ¹Sudip Chowdhury and ¹Souvik Ganguly

¹Department of Agriculture, Government of West Bengal, India

²Department of Agronomy, School of Agriculture, Lovely Professional University,
Phagwara, Punjab, India

Email: rajarshi696@gmail.com

Rice is the staple food of South Asia, in particular, the Indian sub-continent. Like India, China, Japan, the Philippines, and other neighboring South and South East Asian populations also prefer rice to wheat.

Indians used to have the general propensity for white Rice, not only for their habitual preference but also due to some sort of a perception of the cleaner appearance of the polished grain. That's why it is not surprising that 'Black rice' is relatively under-preferred rather unknown to most Indians. Black rice is actually indigenous to North-East India and is extensively grown in Odisha, West Bengal, and Jharkhand. It is commonly consumed in Manipur because of its numerous medicinal values. In their indigenous language, it is called as 'chak-hao', ('chak' meaning rice, 'ahaoba' meaning delicious), which is eaten during traditional feasts. In imperial China, black rice (*Oryzasativa*L.) was forbidden, not because it looked poisonous because of its black color, but because of its high nutritional value, which meant it could only be consumed by the Emperor.

In recent times, rice researchers have begun to study the sticky varieties of black rice, rediscovered and re-explored its several medicinal and nutritional properties. Black rice is a range of rice types of the species *Oryza sativa* L. some of which are glutinous rice. Several varieties of black rice are available in the market today. It is gradually gaining consumer preference and getting popularised especially among the health-conscious people of the world because of its high nutritional value as well as other medicinal properties, including better antioxidant activity and anti-carcinogenic property.

History of Black Rice

It has a rich cultural history, called "Forbidden" or "Emperor's" rice; it was reserved for the 'Emperor' in ancient China and considered as a tribute food. In the time since it remained popular in certain regions of China and recently has become prized worldwide for its high levels of antioxidants. Despite its long history, the actual origin of black rice is still obscure. Black rice cultivars are found in several locations scattered throughout Asia (Oikawa, 2015).

Varieties of Black Rice

1. **Kalabhaat-** Kalabhaat is speckled black in appearance, slender, and firm. Once cooked, it produces rich purple glutinous rice.
2. **Kalanamak-** Kalanamak rice is said to outshine even the most exclusive Basmati rice in all quality traits except grain length. It is non-basmati rice with short to medium grain length. The aroma of Kalanamak rice, considered to be the gift of 'Gautam Buddha,' is stronger than all Basmati varieties. Elongation after cooking, which is one of the most important quality traits in the international rice market, is 40% greater than Basmati rice.
3. **Manipuri Black Rice-** The unique properties of Manipuri Black rice, offering multiple health benefits, make it completely peerless. This glutinous rice variety is called 'ChakhaoAmubi', which is one type of sticky black rice indigenous to Manipur, whereas 'Chakho' means delicious and 'Ambui' means black.
4. **Black Jasmine Rice -** In Thai, the Black Jasmine Rice is called Khaw-Hom-Nil, which translates as 'Aromatic black onyx rice'. While cooking, the rice gives off an aromatic whiff, one which may remind you of a jasmine infusion.

Nutritional Superiority of Black Rice over other Types of Rice- (100 Gm Cooked Rice)

- **Polished white rice** – 6.8 g protein, 1.2 g iron, 0.6 g fibre
- **Brown rice** – 7.9 g protein, 2.2 g iron, 2.8 g fibre
- **Red rice** – 7.0 g protein, 5.5 g iron, 2.0 g fibre
- **Black rice** – 8.5 g protein, 3.5 g iron, 4.9 g fibre

Black rice is rich in amino acids, fatty acids, antioxidants, flavonoids, anthocyanins, and other phenolic compounds. There are 18 amino acids with a mix of essential and non-essential types, iron, zinc, copper, carotene, and several important vitamins in black rice. Amino acids are crucial to many of the human body's functions, from helping repair skin and tissues to improving energy levels and digestion. (Saikia, Partha 2020)

Health Benefits of Black Rice

The main component of black rice that provides almost all of its health benefits is anthocyanin. This protein works as a powerful antioxidant and serves a number of functions like fighting cancer, preventing cardiovascular diseases etc.

1. Rich Source of Antioxidants:

The bran of the grains of black rice contains the highest levels of anthocyanins found in any food. In fact, it has the highest anthocyanin content compared to all other rice varieties (Chang *et al.*, 2010).

2. Fights against Cancer:

The anthocyanin content of black rice lends it an anti-cancer characteristic. It can successfully suppress tumor growth and the spread of breast cancer (Hu C *et al.*, 2003).

3. Improves heart health:

High cholesterol is a leading cause of a number of cardiovascular diseases. But the anthocyanin content of black rice has been found to have a significant effect in reducing cholesterol.

4. Helps in liver detoxification:

Fatty liver disease is, as is obvious, characterized by excessive fat deposit build-up in the liver. The effectiveness of black rice in treating this condition was tested in mice.

5. Prevents diabetes:

Whole grain black rice has its bran intact, which is a storehouse of dietary fibre. Since fibre takes a longer time to digest, it makes sure that the sugar in the grain is absorbed over a longer period, maintaining normal blood sugar levels.

6. Protects from high blood pressure:

The dietary fibre obtained from black rice (or any whole grains in general) has been found to protect cardiovascular health by not only maintaining normal blood pressure but also by reducing lipid levels, regulating body weight, improving glucose metabolism, and reducing chronic inflammation.

7. Improves Eye health:

Along with protective anthocyanins, black rice contains a high amount of lutein and zeaxanthin, two carotenoids known for their role in supporting eye health. These antioxidants help to protect the cells in the eyes and to reduce the effects of ultraviolet (UV) radiation.

Area Expansion under Black Rice Cultivation

In India, black rice or Chak-hao (delicious rice) has been indigenous to the north-eastern state of Manipur for centuries. Till some years ago, it was mostly consumed locally, and little was exported. However, better price realisation and growing demand for this paddy internationally has been enticing farmers across the country to cultivate rice grains of a different colour. In recent times, Assam, West Bengal, Jharkhand, Odisha, Karnataka, U.P are all cultivating this nutrient-dense rice and boosting their farm incomes considerably with exports to Australia, UK, USA, Thailand, Denmark, and Malaysia, among others.

Table 1: Financial profitability of Black rice cultivation over HYV rice cultivation

Particulars (Rs/acre)	High yielding variety of rice	Indigenous aromatic rice
Input cost (Rs/acre)	9300	8200
Human labour cost (Rs./acre)	8200	7300
Total cost of cultivation (Rs./acre)	17500	15500
Average yield (q/acre)	26	11

Price (Rs./q)	1850	6500
Gross Return (Rs/acre)	48100	71500
Net Return (Rs/acre)	30600	56000
B:C	1.74	3.61

Though much lower yield is generally attained from Black rice as compared to high yielding rice varieties but it can fetch a higher market price that in turn will offer higher profit to the farmers if proper procurement facilities and stable marketing channel can be established and ensured (Sharma *et al.*, 2019).

Conclusion

A promising prospect of Black rice can be expected in the near future as it may earn much more net returns and achieve a stable benefit-cost ratio as compared to high yielding rice varieties. Besides economic benefit, the nutritional and medicinal superiorities of black rice over normal white rice makes its cultivation popular in recent times all over India.

References

Saikia, Partha. "Black Rice-Nutrition, Recipe & Benefits (Manipuri Black Rice)". *North East India info*. Retrieved 2020-06-25.

"Heirloom rice preserved, made productive". Philippine Rice Research Institute. Department of Agriculture, Philippines. 2017-02-20. Retrieved 29 June 2018.

Yao, S. L.; Xu, Y; Zhang, Y. Y.; Lu, Y. H. (2013). "Black rice and anthocyanins induce inhibition of cholesterol absorption in vitro". *Food & Function*. **4** (11): 1602–8.

"Food Grains of India". Bulletin of Miscellaneous Information (Royal Botanic Gardens, Kew). 232-234. **1892** (70): 234. 1892. [JSTOR 4102547](https://www.jstor.org/stable/4102547).

Oikawa, T.; Maeda, H.; Oguchi, T.; Yamaguchi, T.; Tanabe, N.; Ebana, K. Yano; M., Ebitani; T., Izawa, T. (2015). "The birth of a black rice gene and its local spread by introgression". *Plant Cell*. **27** (9): 2401–2414.

Ichikawa, Haruyo; Ichiyangi, Takashi; Xu, Bing; Yoshii, Yoichi; Nakajima, Masaharu; Konishi, Tetsuya (2001). "Antioxidant activity of anthocyanin extract from purple black rice". *Journal of Medicinal Food*. **4** (4): 211–218.

Abdel-Aal, El-Sayed M; Young, J. Christopher; Rabalski, Iwona (2006). "Anthocyanin composition in black, blue, pink, purple, and red cereal grains". *Journal of Agricultural and Food Chemistry*. **54** (13): 4696–704.

"Food Data Central". fdc.nal.usda.gov. Retrieved 2020-06-25.

Saikia, Partha. "Black Rice-Nutrition, Recipe & Benefits (Manipuri Black Rice)". *North East India Info*. Retrieved 2020-06-25.

Hu C, Zawistowski J, Ling W, and Kitts DD, Black rice (*Oryza sativa* L. indica) pigmented fraction suppresses both reactive oxygen species and nitric oxide in chemical and biological model systems. *J Agric Food chem* 2003; 51: 5271-5277.

Hennekens C.H, and Gaziano, J.M., Antioxidants and Heart Disease: Epidemiology and Clinical Evidence. *Clin Cardiol*, 1993; 16(suppl I):I-10, I-15).

Shiv Kumar Sharma et al. (2019) "Cost Benefit analysis of Black Rice Cultivation in Padumani Development Block of Golaghat District of Assam, India "*International journal of basic and applied research* ISSN 2249-3352 (P) 2278-0505 (E) June 2019 Volume 9.

Chang, K. K., Kikuchi, S., Kim, Y. K., Park, S. H., Yoon, U., Lee, G. S., Choi, J. W., Kim, Y. H., & Park, S. C. (2010). Computational identification of seed specific transcription factors involved in anthocyanin production in black rice. *Biochip Journal*, 4(3), 247–255. <https://doi.org/10.4137/EBO.S6077>

Kumane U, Singh K. Black rice Research, History and development. *Springer Int Publishing*. 153(2):21-190.

Saha soma. Black rice: The new age super food (an extensive review). *Am Int J Res in Formal, Applied Natural Sci*. 2016;16(1):51-55.