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BPT 2848 - A Black Rice Variety with High Protein Content and Anti - oxidant Activity

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Abstract

BPT 2848 is a black pericarp coloured rice variety which was registered with NBPGR as genetic stock for high protein content (10.5%) in polished rice. It is a cross between Improved Samba Mahsuri*1 and IRGC 48493. It has 125-130 days duration coupled with tolerance to bacterial blight, blast and BPH. BPT 2848 has medium slender grain which recorded intermediate amylose content and alkali spreading value hence the cooked rice will be soft and flaky. Due to its black pericarp, it exhibits high anti-oxidant activity, high total phenol content and flavonoid content which has potential health benefits. It can be utilized in making food products to utilize its rich phytochemicals content and nutraceutical properties to combat the malnutrition.

Keywords: Black rice, protein content, Anti-oxidant activity, micronutrient, flavonoid content.

Rice (*Oryza sativa* L.) is the predominant staple food crop for more than half of the world's population and plays a pivotal role in human nutrition, energy supply and food security. Even though rice protein content is slightly lower than other cereals, with respect to protein quality, the rice protein amino acid profile is better balanced compared to other cereals such as wheat and maize (Hegsted, 1969). Therefore, the impact of improving the protein content in rice would be enormous in combating the protein energy malnutrition which is prevalent in more than one third of world's child population. Research on biofortification of rice was initiated a decade back at Agricultural Research Station, Bapatla and many genotypes possessing high protein and micronutrient content were identified. Among these, one advanced breeding line *viz.*, BPT 2848 was identified as possessing high protein content and was nominated to IVT-Biofortification trial conducted under AICRP on rice. BPT 2848 (IET 28692) is a derivative of the cross between RP Bio 226*1 and IRGC 48493 which was developed through pedigree method of breeding at Agricultural Research Station, Bapatla. The performance of BPT 2848 for protein content in IVT-Biofortification trial during *kharif*, 2019 including 4 checks (IR 64 and BPT 5204 as yield checks and DRR Dhan 45 and Chittimuthyalu as micronutrient checks) revealed that BPT 2848 recorded highest overall mean protein content of 10.5% in polished rice among all the entries tested**.** The two micronutrient checks *viz.*, DRR Dhan 45 and Chitimuthyalu recorded 6.43% and 8.30% mean protein content on overall basis respectively. IET 28692 recorded more than 10.0% protein content in polished rice at 5 locations *viz.*, Jeypore (13.17%), Cuttack (13.33%), Sirsi (10.52%), Aduthurai (12.28%) and Coimbatore (10.36%), out of 9 testing locations **(Table 1)**.

BPT 2848 (IET 28692) possess medium slender grain with straw glume and black pericarp and has a test weight of 13.5 g to 14.0 g. BPT 2848 matures in 125-130 days duration during *kharif* season and recorded a mean grain yield of 4415 kg/ha on over all basis when tested at 20 locations in IVT-Biofortification trial. In this trial, the yield check BPT 5204 recorded 4484 kg/ha and micronutrient check variety

Table 1: Protein content (%) of polished rice samples of BPT 2848 in Initial Variety Trial-Biofortification (IVT-Biofortification) at different locations analysed at ICAR-NRRI, Cuttack, *Kharif*, 2019

IET No	JYP	CTK	SKL	NVS	SRS	ADT	CBT	MNC	MTU	Overall Mean
IET 28692 (BPT 2848)	13.17	13.33	7.17	8.83	10.52	12.28	10.36	9.46	9.34	**10.50**
BPT 5204	8.12	7.79	7.45	6.17	6.00	8.36	8.93	7.92	5.47	**7.36**
DRR Dhan 45	7.11	7.94	4.43	5.53	5.44	6.53	6.59	6.22	8.08	**6.43**
Chittimuthyalu	7.85	7.88	8.65	7.17	7.62	9.32	9.10	9.52	7.60	**8.30**
IR 64	7.82	7.78	5.19	6.65	6.00	6.72	6.86	-	6.32	**6.67**

Source: AICRP trials data from IVT-Biofortification trial from Varietal Improvement Progress Report Volume 1

Chittimuthyalu recorded 3671 kg/ha. BPT 2848 recorded 13.2% protein content in unpolished rice (**Table 2**). BPT 2848 possesses intermediate amylose content (22.46%) and alkali spreading value (4.3) which determines the soft and flaky texture of cooked rice. It also recorded high total phenol content (123.31 mg/100 g), high flavonoid content (784.54 mg/100 g) and anti-oxidant activity (86.63 mg/100 g) which plays a major role in free radical balance. The phenolic compounds are also known as antioxidants and are likely to have functional effects against oxidative damage and associated with reduced risk of chronic diseases such as diabetes and cardiovascular diseases (Adom and Liu 2002; Liu, 2007). Unlike other *desi* glutinous black rice varieties, it possesses intermediate amylose content and alkali spreading value, hence cooks soft and flaky which is preferred by South Indian consumers. Li *et al.,* (2016) also stated that the amylose content of the rice variety has culinary implications because it has an influence on the organoleptic qualities of rice once cooked.

Recently, pigmented rice varieties have been receiving increased attention from health conscious consumers for their high bioactive compounds which possess potential nutraceutical benefits to human health. During the last few decades, the people have been more concerned about the natural health supplements from food resources. Rice has good quality protein compared to other cereals (Juliano, 1993) and is rich in branched chain amino acids such as leucine, isoleucine and valine. According to Ke *et al.,* (2018), protein is an important modulator in glucose homeostasis by increasing gluconeogenesis and preventing insulin

Table 2: Physico-chemical, nutritional and biochemical quality characteristics of BPT 2848

Sl. No	Quality parameter	BPT 2848	Sl. No	Quality parameter	BPT 2848
1	Kernel length (mm)	5.63	11	Protein content (%) in polished rice	10.5
2	Kernel breadth (mm)	1.96	12	Crude fiber (%)	1.21
3	Length/ breadth ratio	2.88	13	Carbohydrate (%)	73. 17
4	Grain type	Medium slender	14	Energy (Kcal.)	358
5	Volume expansion Ratio	3.73	15	Fe content (ppm)	12.30
6	Water uptake (ml)	417	16	Zn content (ppm)	18.00
7	Alkali spreading value	4.33	17	Total Antioxidant activity in unpolished rice (mg AAE/100 g)	86.63
8	Gel consistency (mm)	78.0	18	Total anthocyanin content in unpolished rice (mg C3g/100 g)	24.99
9	Amylose content (%)	22.48	19	Total phenol content in unpolished rice (mg GAE/100 g)	123.31
10	Protein content (%) in unpolished rice	13.2	20	Flavonoid content in unpolished rice (mg GAE/100 g)	784.54

resistance, hence genotypes possessing high protein content digest slowly and aids in slow release of blood glucose. Due to its high protein content, high bioactive compounds coupled with desirable cooking quality, BPT 2848 black rice may be included in daily diet to get potential nutraceutical benefits to health.

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