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# BIOCHEMICAL TRAITS OF SOME RICE VARIETIES GROWN UNDER SHALLOW WATER DEPTH

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**Abstract:** A field experiment was conducted at the Adaptive Research Station, Sakhigopal, Puri during *Kharif*-2012 to study the bio-chemical basis of yield variation in the newly released rice genotypes. Nine rice genotypes viz. Tanmayee, Mrunalini, Tejaswini, Swarna, OR-2327-23, OR-2324-8, Pratikhya, Hiranmayee and Swarna sub-1 were taken into test under shallow water depth condition in the field in a randomised block design (RBD) in three replications. Chlorophyll-a and total chlorophyll content was found to be maximum in Tanmayee. The content of nutritional components of grain such as protein starch and sugar was highest in Tanmayee (7.8%, 2.5%, 86.3%) respectively and lowest in Hiranmayee (6.7%, 2.0%, 78.3%) respectively. It was found that the genotypes Tanmayee showed highest chlophyll–a as well as chlorophyll-b content. Tejaswini, Tanmayee & Pratikhya showed highest content of protein, starch and sugar in their grains respectively. It was concluded that those varieties can be recommended to the farmers for cultivation under shallow water depth in study area.
**Keywords:** Biochemical traits, chlorophyll-a, chlorophyll-b, total chlorophyll, protein, starch, sugar content.

## INTRODUCTION

Rice is one of the most important cereal crops, cultivated in varied diverse ecosystem ranging from flood to drought condition (Dixit, 2012). It provides about 31% and 17% of the total calories and protein requirement respectively for which it is considered as a staple food of (88.2%) of Indian population. In India rice is grown in almost all the states under widely varying conditions of altitudes and climates. Its cultivation in India is extended from $19^0 48'$N latitude from the sea level to as high as 6 metres. So in order to feed to the ever increasing population under reduced area declining impact use efficiency having limited irrigation facilities in rainfed ecosystem the suitable variety should be cultivated in respective lands in appropriate time but; due to the biotic and abiotic stresses the genetic potentiality of a crop variety is limited (Oreke,1999). Rice primarily a highly energetic, high calorie food. This is a

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major source of protein in Asian diet. The protein content of milled rice is usually 7.3%. Among the cereals, it has high protein quality. It is relatively rich in lysine which is a commonly limiting essential amino acid of cereals. During milling much of the fat is lost for which the fat content of rice is very low (2-2.5%). Like wheat crop rice grain contains much of B-group of vitamins. The greater attention has been given by the agricultural scientists to increase the rice production/unit area as it has been observed that the yield of rice is low and stands 2$^{nd}$ position in the world. Agricultural scientists made tremendous strides in this sphere and affords such in achieving at the goal. As the possibility of bringing more area under this crop is rather reduced; so, the yield /unit area can only be increased through the use of suitable varieties and recommended agricultural practices. Yield variation in different rice genotypes of rice is governed by both genetic and environmental factor. These two factors influence the growth, development, yield and its attributing characters as well as biochemical changes in rice.

**MATERIALS AND METHODS**

A field experiment on rice was conducted during *kharif* 2012 in the Adaptive Research Station, Sakhigopal, Puri to study the biochemical characters responsible of the rice genotypes under shallow water depth condition which are related for yield of the crop. The Adaptive Research Station, Sakhigopal is situated in 19°48' North Latitude and 85°52' East Longitude and 20 kms away from Bay of Bengal with an altitude of 6m above the mean sea level. The climate is relatively warm and humid in nature with short mild winter. The average annual rainfall of Sakhigopal is 1408.8mm which is received from South-West monsoon during 2012. The total precipitation was about 1405 mm which has been received from June to December. The date of sowing in the nursery bed was conducted from 7th June, 2012. The nursery bed was developed for planting of six varieties of rice as mentioned above. Required amount of FYM and phosphatic fertilizers were well mixed with the soils of nursery for development of fertility of soil, before date of sowing. The six varieties were sown by in lines with keeping appropriate spacing between the varieties. The irrigation channels were kept surrounding the speed beds. Frequent sprinkler irrigation was given for seedbed initially and after germination irrigation management was done in such a manner that the raised seed bed remained moistened without any standing water over its surface for one week. Thereafter standing water was maintained up to 3cm for the better growth of seedlings minimum N-fertilizer was given in seed bed. Before 7 days of rooting of seedling granular pesticide as per

as recommendation was applied in seed bed in order to avoid the infection of disease and pest after the transplanting. After 30 days of sowing the seedling was up rooted for transplanting.

The mainland (50m x 40 m) was ploughed with tractor after harvest of the previous crop. Then FYM @ 5t $ha^{-1}$ was spread over the field. Again the yield was cross-ploughed and levelled properly. Two days prior to transplanting for each sowing the irrigation was given to a plot size of 100 $m^2$ for puddling by the power tiller and a little standing water was maintained in the field. Further, main plot was divided into three stripes representing 3 replications. Each replication was subdivided into 22 subplots for the allocation of varieties.

Before transplanting of seedlings and basal dose of 25kgN, 30Kg $P_2O_5$ and 30 Kg $K_20$ per hectare were applied and mixed thoroughly in soil during piddling. Rest nitrogen was top dressed twice. The first top dressing of nitrogen @30Kg $ha^{-1}$in the form of Urea was applied after 15 days of transplanting. The second top dressing of nitrogen @ 25kg $ha^{-1}$in the form of Urea was applied at 112 days after transplanting.

Thirty days old seedlings of rice genotypes were transplanted in the main field on 07.07.2012 with a spacing of 20cm x 15cm having two seedlings per hill.

The crop was harvested on 5 December 2012 after it attained physiological maturity. The plant material for the biochemical evaluation was collected from five randomly selected competitive plants in each replication for all the parameters at growing stage and tagged for recording a representative sample of the entire population. After harvesting grains were collected to determine starch and protein. Total chlorophyll content in the leaves were determined by using the method stated by Arnon (1949). Proline estimation was done as per the protocol described by Sadasivam and Manickam (1996) and Gilmour et al., 2005. Carbohydrate content of plant samples was determined by following procedure (Yosidha et al., 2005).

## RESULTS AND DISCUSION

### Chlorophyll content of the leaves:

The chlorophyll-a content of the leaves was measured at heading stage of different rice genotypes and the result was registered in **(Table-1)**. From the data it was revealed that maximum chlorophyll-a content was exhibited by Tejaswini (1.7mg $gm^{-1}$ of fresh weight) followed by Mrunalini and Swarna (1.5 mg $gm^{-1}$ of FW) whereas, the lowest value of the same was noted in both Pratikhya and Hiranmayee (1.1mg $g^{-1}$ of fresh weight). Statistically it was found that significant difference was noted among the replication and the genotypes. There was greater variance in chlorophyll-a content as per the CV value. Chlorophyll-b

content of the leaves at heading stage of the rice genotypes under shallow water depth condition was measured and the result was recorded in **(Table-1)**. The data reflected in the table revealed that both Tanmayee and Mrunalini exhibited the highest value (0.6mg $g^{-1}$ of FW) of the chlorophyll-b content followed by Tejaswini, Swarna and OR-2327-23 all of which contributed the same chlorophyll-b content. Whereas, the lowest value of the same was noted in both Hiranmayee and Swarna sub-1 (0.3mg $g^{-1}$ of fresh weight). Statistical analysis of the tabulated data showed that there was significant difference among the genotypes and the replications as per the CV value. As per the data tabulated in **(Table-1)**, the total chlorophyll content was found to be highest in Tanmayee (2.5mg/g of fresh weight) followed by Tejaswini (2.4mg $g^{-1}$ of fresh weight) whereas the, the lowest total chlorophyll content was exhibited by Swarna sub-1(1.8mg $g^{-1}$ of fresh weight).

Irrespective of the genotypes there was very little difference in chlorophyll-a, chlorophyll-b and total chlorophyll among the genotypes **(Table-1)**. However, there was a very wide variation in all fraction of chlorophyll content among the genotypes. In the present study, Tanmayee exhibited highest chlorophyll-a, chlorophyll-b and total chlorophyll content among the genotypes whereas, the minimum value was observed in Hiranmayee. The correlation study revealed that chlorophyll-a and total chlorophyll content of leaves showed significantly positive correlation with percentage of ripened grains/panicle and HI. Similarly correlation between chlorophyll-a and ripened grains $panicle^{-1}$ was significant. A significant difference was noted among the genotypes as per the statistical analysis.

**Content of Protein, Starch and Sugar:**

Data presented in **(Table-2)** indicated that the average protein, sugar and starch content were 7.3%, 2.36% and 81.86% respectively. Irrespective of the genotypes, the starch content of the grain was about 91 times and 96 times higher than protein and sugar content respectively**;** similarly protein content of the grain was 68 times higher than the sugar content. It was found that the nutritional component of the grain sugar content exhibited wide variation among the cultivars. However, protein and starch content showed little variation as per the CV value. From the data it was found that Tejaswini exhibited the highest protein content 7.9% whereas, the lowest value of the same was showed in Hiranmayee 6.7% followed by OR-2324-8 6.8%. Sugar content of the grain of the genotypes varied from 2.0% to 2.5% and the highest value of the same was showed in Mrunalini and the lowest in OR-2324-8**(Table-2)**. As compared to variation in starch content among the genotypes Tanmayee exhibited the highest starch content 86.3% followed by OR-2324-8 85.1%. On the other hand, Hiranmayee

78.3% had the lowest value followed by Tejaswini 78.6%. The starch content varied from 78.3% in Hiranmayee to 86.3% in Tanmayee among the tested genotypes. Percentage of protein, starch and sugar in the genotypes showed that the average protein, sugar and starch content of the genotypes were 8%, 3% and 92% respectively **(Table-2)**. Irrespective of the genotypes, starch content of the grain was about 11.5 and 30 times higher than protein and sugar respectively. Among the genotypes highest protein content was observed in Tejaswini 7.8% whereas, maximum sugar percentage was observed in Pratikhya 2.6% but; highest starch content was showed in Tanmayee 86.3%.

**Table-1. Variation in Chlorophyll-a, Chlorophyll-b & Total Chlorophyll content of the leaf of the rice genotypes**

| *Variety* | *Chlorophyll-a (mg/g FW leaf)* | *Chlorophyll-b (mg/g FW leaf)* | *Total Chlorophyll (mg/g FW leaf)* |
|---|---|---|---|
| **Tanmayee** | 1.7 | 0.6 | 2.5 |
| **Mrunalini** | 1.5 | 0.6 | 2.3 |
| **Tejaswini** | 1.4 | 0.5 | 2.1 |
| **Swarna** | 1.5 | 0.5 | 2.1 |
| **OR-2327-23** | 1.3 | 0.4 | 2.0 |
| **OR-2324-8** | 1.2 | 0.4 | 1.9 |
| **Pratikhya** | 1.1 | 0.3 | 1.7 |
| **Hiranmayee** | 1.1 | 0.3 | 1.6 |
| **Swarna sub-1** | 1.3 | 0.45 | 1.8 |
| **Mean :** | 1.0 | 0.45 | 2.03 |
| **SEM :** | 0.045 | 0.017 | 0.063 |
| **CD 5%** | 0.126 | 0.047 | 0.176 |
| **CV %** | 5.21 | 5.75 | 4.95 |

**Conclusion**

It was found that the genotypes Tanmayee showed highest chlophyll–a as well as chlorophyll-b content. Tejaswini, Tanmayee & Pratikhya showed highest content of protein, starch and sugar in their grains respectively. It was concluded that those varieties can be recommended to the farmers for cultivation under shallow water depth in study area.

**Table-2 Variation *in* Protein, Sugar & Starch % in the grain of the rice genotypes.**

| *Variety* | *Protein (%)* | *Sugar (%)* | *Starch (%)* |
|---|---|---|---|
| **Tanmayee** | 7.8 | 2.4 | 86.3 |
| **Mrunalini** | 7.4 | 2.5 | 83.4 |
| **Tejaswini** | 7.9 | 2.2 | 78.6 |

| | | | |
|---|---|---|---|
| **Swarna** | 6.9 | 2.5 | 80.5 |
| **OR-2327-23** | 7.2 | 2.3 | 81.5 |
| **OR-2324-8** | 6.8 | 2.0 | 85.1 |
| **Pratikhya** | 7.5 | 2.6 | 82.5 |
| **Hiranmayee** | 6.7 | 2.5 | 78.3 |
| **Swarna sub-1** | 7.6 | 2.3 | 80.6 |
| **Mean :** | 7.3 | 2.36 | 81.86 |
| **SEM:** | 0.149 | 0.098 | 0.373 |
| **CD 5%** | 0.417 | 0.274 | 1.046 |
| **CV %** | 3.15 | 6.41 | 0.70 |

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