

Original Research Article

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## Morphological, Biochemical and Physiological Basis of Yield Variation among Promising Rice (*Oryza sativa* L.) Genotypes

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### ABSTRACT

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A field experiment was conducted with 6 pre-release cultures, 5 pre-release rice hybrids and 2 checks genotypes to study the yield variation during *kharif*. RTN-49-2-3-1-2 took minimum time for flowering and maturity. Maximum grain yield (31.76 g/plant) was recorded in RTNRH-10 followed by RTNRH-17 (30.40 g/plant). Photosynthesis rate and stomatal conductance was found significantly higher in RTN-13-4-2-3-1 (23.446  $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ sec}^{-1}$ ) and RTNRH-10 (0.0603  $\mu\text{mol H}_2\text{O m}^{-2} \text{ sec}^{-1}$ ) respectively. Total chlorophyll content was higher in RTNRH-10 (1.5723 mg/g). RTNRH-10 recorded maximum grain yield as compared to other genotypes.

### Introduction

Rice is one of the most important food grain crops of the world. Rice is the staple food of most of the peoples in Asia. The problem for variation in yield in terms of growth and development of crop plant is obviously very complex as it ultimately involves the interactions of external factors with the physiological processes of plant. For understanding the causes for variation in grain yield as well as attempts forward increasing grain yield, a physiological approach is basic such an approach and understanding is useful for proper crop management to maximize the yield and also evolving high yield plant types.

Grain yield in rice is a complex character which is influenced by several physiological factors and hence the selection made for one character generally brings about a simultaneous change in others. The present investigation was undertaken to study the physiological basis of yield variation among promising rice.

### Materials and Methods

A field experiment was conducted during *kharif* at research farm of Department of Agril. Botany, College of Agriculture, Dapoli. Dist- Ratnagiri, Maharashtra State on lateritic soil with 6 pre-release cultures, 5 pre-release

hybrids and 2 checks. The experiment was laid following randomized block design with three replications. The plot size was 2 x 2.25 m and each genotype with ten rows and fifteen plants in each row. Recommended dose of nitrogen, phosphorous, potassium i.e. 100, 50, and 50 kg/ ha respectively were applied. Recommended package of practices were followed. The photosynthesis rate and stomatal conductance was measured by infrared gas analyzer (LICOR- 6400). The total chlorophyll content of the leaves was calculated by Arnon (1969). The yield and yield components were recorded at harvest. The data was analyzed statistically.

## Results and Discussion

### Growth parameters

Experimental results revealed that all the genotypes perform in terms of vegetative growth (Table-1). Highest plant height (98.87cm) was recorded in KJTRH-21 followed by RTNRH-17, RTNRH-10, RTNRH-18, RTN-49-1-1-2 and RTN-1-1-2-1. Ligen (1994) also observed hybrids with taller canopy and grain yield. Highest total number of tillers per plants was recorded in RTNRH-17(15.27) followed by genotypes RTNRH-10 and RTNRH-18. The variability for tiller number in rice has been reported by Golam (2001). Genotypes RTN 49-2-3-1-2, RTN-1-1-2-1, RTN-99-1-2 and KJTRH-21 took minimum time for flowering and maturity. However, RTNRH-10, RTNRH-14 and RTNRH-17 took longer duration for flowering and maturity. The variation in days to flowering and maturity was also reported by Srinivasulu *et al.*, (1999).

### Yield and yield attributes

Perusal of the data (Table 1) revealed that number of panicles per plant was maximum in RTNRH-10 (13.30) recorded significantly

highest number of panicle per plant than rest of the genotypes expect RTNRH-17. Similar results were in accordance with Surekha *et al.*, (1999) and Golam (2001). The number of spikelets per panicles was highest in RTN-49-1-1-2 and RTNRH-10. Such a variation in respect of number of spikelets per panicle was also reported by Subramanian *et al.*, (1998). 1000 grain weight was maximum in RTNRH -17 and RTNRH-10. The varietal difference for 1000 grain weight in rice have also been reported by Vange *et al.*, (1999), Chandrashekhar *et al.*, (2001) and Rajendran *et al.*, (2002). RTNRH-10 (31.76g/plant) recorded highest grain yield per plant followed by RTNRH- 17 (30.40g /plant) as compared to other genotypes. Variation in grain yield in rice has been also reported by Hari *et al.*, (1997), Golam (2001) and Ramarao (2004).

### Physiological parameters

RTNRH-10 (18.557 $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ sec}^{-1}$ ) and RTN-13-4-2-3-1(23.446  $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ sec}^{-1}$ ) recorded significantly highest rate of photosynthesis at 60 DAS and 90 DAS respectively. The varietal difference for photosynthesis rate was also reported by Sharma *et al.*, (1997), Pramodkumar (2000) and Pramodkumar (2002). RTN-13-4-2-3-1 (0.0497  $\mu\text{mol H}_2\text{O m}^{-2} \text{ sec}^{-1}$ ) and RTNRH-10 (0.0603  $\mu\text{mol H}_2\text{O m}^{-2} \text{ sec}^{-1}$ ) recorded significantly highest stomatal conductance at 60 and 90 DAS respectively.

The varietal variation for stomatal conductance was also reported by Pramodkumar *et al.*, (2000) and Selvi *et al.*, (2001). At 60 DAS, RTN-13-4-2-3-1 (2.0662 mg/g) recorded highest total chlorophyll content followed by KJTRH-21. At 90 DAS, RTNRH-10 (1.572 mg/g) recorded maximum total chlorophyll content followed by RTN-8-4-2-1-2. The varietal difference was also reported by Prasmokumar (2002), Chauhan *et al.*, (2003) and Ghosh *et al.*, (2003).

**Table.1** Growth, yield and yield attributes of promising rice genotypes

| Genotypes        | Plant height (cm/plant) | No. of tillers /plant | Days to 50% flowering | Days to maturity | No. of panicles /plant | No. of spikelets / panicle | 1000 grain weight | Grain yield per plant (g/plant) |
|------------------|-------------------------|-----------------------|-----------------------|------------------|------------------------|----------------------------|-------------------|---------------------------------|
| RTN-49-1-1-2-2-1 | 93.48                   | 10.77                 | 96.39                 | 125.53           | 8.47                   | 173.27                     | 24.14             | 24.20                           |
| RTN-8-4-2-1-2    | 87.52                   | 12.47                 | 98.35                 | 130.93           | 9.60                   | 152.87                     | 23.23             | 26.30                           |
| RTN-49-2-3-1-2   | 90.29                   | 12.40                 | 85.71                 | 116.43           | 8.60                   | 152.22                     | 21.55             | 22.74                           |
| RTN-99-1-2       | 83.93                   | 11.47                 | 88.50                 | 118.27           | 7.70                   | 148.07                     | 15.25             | 15.49                           |
| RTN-1-1-2-1      | 93.35                   | 12.40                 | 87.59                 | 117.37           | 6.53                   | 134.47                     | 22.69             | 20.72                           |
| RTN-13-4-2-3-1   | 85.52                   | 12.60                 | 100.74                | 130.80           | 9.93                   | 174.93                     | 26.33             | 27.37                           |
| KJTRH-21         | 98.87                   | 11.27                 | 87.60                 | 118.40           | 11.40                  | 148.73                     | 24.64             | 27.28                           |
| RTNRH-18         | 93.51                   | 13.33                 | 99.10                 | 144.87           | 10.47                  | 174.93                     | 23.75             | 28.36                           |
| RTNRH-14         | 86.81                   | 11.20                 | 110.70                | 141.40           | 9.67                   | 159.53                     | 19.54             | 27.37                           |
| RTNRH-17         | 94.22                   | 15.27                 | 105.73                | 143.20           | 12.80                  | 149.33                     | 27.24             | 30.40                           |
| RTNRH-10         | 94.13                   | 14.07                 | 111.00                | 141.33           | 13.30                  | 167.53                     | 25.42             | 31.76                           |
| Jaya             | 78.41                   | 11.40                 | 102.73                | 132.60           | 6.33                   | 131.60                     | 22.07             | 16.00                           |
| Sahyadri-3       | 86.40                   | 12.07                 | 98.53                 | 127.70           | 7.73                   | 106.53                     | 20.27             | 14.74                           |
| SEm ±            | 2.53                    | 0.80                  | 0.79                  | 0.86             | 0.65                   | 4.72                       | 0.96              | 0.97                            |
| CD (5%)          | 7.39                    | 2.35                  | 2.31                  | 2.52             | 1.90                   | 13.80                      | 2.80              | 2.84                            |

**Table.2** Physiological parameters of promising rice genotypes

| Genotypes        | Photosynthesis rate ( $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ sec}^{-1}$ ) |           | Stomatal conductance ( $\mu\text{mol H}_2\text{O m}^{-2} \text{ sec}^{-1}$ ) |           | Total Chlorophyll content (mg/g) |           |
|------------------|--|-----------|--|-----------|----------------------------------|-----------|
|                  | At 60 DAS  | At 90 DAS | At 60 DAS  | At 90 DAS | At 60 DAS                        | At 90 DAS |
| RTN-49-1-1-2-2-1 | 11.363   | 20.989    | 0.0271   | 0.0509    | 1.831                            | 1.223     |
| RTN-8-4-2-1-2    | 10.606   | 17.461    | 0.0377   | 0.0538    | 1.890                            | 1.396     |
| RTN-49-2-3-1-2   | 3.032  | 12.820    | 0.0224   | 0.0342    | 1.377                            | 0.858     |
| RTN-99-1-2       | 1.138  | 10.296    | 0.0203   | 0.0568    | 1.885                            | 0.523     |
| RTN-1-1-2-1      | 7.169  | 20.197    | 0.0054   | 0.0323    | 1.533                            | 0.885     |
| RTN-13-4-2-3-1   | 16.886   | 23.446    | 0.0497   | 0.0567    | 2.066                            | 0.987     |
| KJTRH-21         | 14.792   | 19.991    | 0.0233   | 0.0401    | 1.975                            | 1.133     |
| RTNRH-18         | 9.463  | 22.054    | 0.0241   | 0.0456    | 1.346                            | 0.988     |
| RTNRH-14         | 12.357   | 19.610    | 0.0348   | 0.0456    | 1.322                            | 1.122     |
| RTNRH-17         | 13.826   | 23.139    | 0.0134   | 0.0333    | 1.544                            | 1.285     |
| RTNRH-10         | 18.557   | 22.414    | 0.0475   | 0.0603    | 1.440                            | 1.572     |
| Jaya             | 8.424  | 19.715    | 0.0166   | 0.0332    | 1.152                            | 0.984     |
| Sahyadri-3       | 3.943  | 8.275     | 0.0167   | 0.0274    | 1.085                            | 0.874     |
| SEm ±            | 0.517  | 0.590     | 0.0164   | 0.0024    | 0.052                            | 0.062     |
| CD (5%)          | 1.509  | 1.723     | 0.0048   | 0.0071    | 0.152                            | 0.181     |

Present investigation results indicate RTNRH-10 was superior to other promising rice genotypes in all aspects viz. growth characters, physiological parameters, yield and yield components.

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