



# Characterization of Rice genotypes for yield and yield attributes

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## Abstract

Rice is the staple food of more than half of the world population especially the Asian countries. The demand for rice is ever increasing as the population growth increases all over the world. However the land, water, labour and other essential input are in a declining trend. To meet out the required production from the limited cultivable land the rice productivity has to be increased from the present level of 4.25 tonnes/ha . Similar is the case in India as well in Tamil Nadu. In Tamil Nadu due to the introduction of many high yielding rice varieties suitable for various districts, the rice productivity has reached to 3.7 tonnes/ha. Research on hybrid development has been intensified to increase the rice productivity more than 10 tonnes/ha as that of China. However, adoption of hybrid rice by farmers is limited due to some limitations of hybrid rice cultivation and seed production. Hence, rice varietal development with high yield potential and other desirable attributes viz., pest and disease resistance, abiotic stress tolerance and grain and cooking quality characteristics by recombination breeding is widely adopted in Tamil Nadu. The present study aims to evolve rice varieties with high yield potential and desirable grain and cooking quality traits through recombination breeding involving suitable parental genotypes. In the present study the rice varieties ASD 16, ADT 36, TKM 9, ADT 37, ADT 42, TPS 4, Improved white ponni, Pusa Basmati and BPT 5204 were crossed and the cultures were selected by pedigree breeding. The replicated yield trials PYT and AYT were conducted in RBD and the promising cultures TP 08053 ( 6739 kg/ha) , TP 08080 ( 7091 kg/ha), TP 08095 (7729) kg/ha and TP 09037 ( 6964 kg/ha )were identified with high yield potential and other desirable attributes. These cultures will be further evaluated in MLT and ART and will be released as varieties for commercial cultivation.

**Key words:** Rice , variety, breeding , yield , Quality.

## Introduction

Rice is the staple food of more than half of world population. It is the third most important crop with respect to production after maize and sugarcane. It is cultivated in more than 100 countries world wide and is considered important socially, economically and culturally. Rice is cultivated in about 160 mha and is the third important cereal. Rice is grown in wide range of climatic conditions and from plains to hilly areas. Generally rice is cultivated in irrigated low land which contributes about 75% of rice production. Rice is also cultivated in low land as rainfed crop where the productivity is less. The crop occupies largest area in India followed by China and Indonesia while the production is highest in China and productivity is highest in Australia. In India rice is the staple food for nearly 65 % population and it contributes 40% global food grain production ( Pandey, 2010). In India about 40% rice area is rainfed mainly in eastern India. Tamil Nadu is one among the major rice growing states with a productivity of 3.7 tonnes/ha next to Punjab. Global demand of rice production is ever increasing with a target of 550 mt in 2030. However, rice farming faces risks due to climate change, limited water resources, labour scarcity, increased cost for inputs, increased cost of cultivation and less income. Hence the goal of rice research must be increasing productivity thereby ushering economic security to the farmer. Development of rice varieties with high yield potential and adaptable to various soil and climatic conditions with resistance to major pest and diseases contributed more than 1000 varieties. In Tamil Nadu nearly 200 rice varieties were released for various agroclimatic regions with desirable yield and yield attributes. Pedigree breeding involving appropriately selected parents is the widely practised method to evolve rice varieties suitable for particular region with desirable yield and quality traits. In the present study the rice genotypes developed by recombination breeding were characterized for yield and yield attributes so as to select the best genotypes for release as varieties.

## Materials and Methods

### Crossing Block and study of segregating Generations

The following rice varieties were crossed in a line x tester mating design along with the reciprocals. The F<sub>1</sub> hybrids were studied for heterosis of yield and yield traits and the hybrids with high yield potential and desirable morphological traits and grain characteristics were selected. The F<sub>2</sub> generation of all the selected F<sub>1</sub> hybrids were raised and single plant selections were made based on yield and other desirable attributes. This process was continued in F<sub>3</sub>, F<sub>4</sub> and F<sub>5</sub> generations. The F<sub>5</sub> population with homogeneity were selected and

studied in replicated yield trials viz., Preliminary yield trial and Advanced Yield trial along with the check varieties.

### **Experimental Design**

The yield trials viz., PYT and AYT were raised in a Completely Randomized Block Design with three replications. Each entry was raised in 3 m x 3m plot with a spacing of 20 cm between rows and 15 cm between plants. All the crop production and protection measures were given so as to express their full genetic potential. All the biometrical observations were recorded in five random plants as detailed below. Analysis of variance was calculated for yield and yield attributes.

### **Biometrical Observations**

#### **Days to Fifty percent Flowering**

The number of days from sowing to 50% plants in the plot attained flowering .

#### **Plant Height**

Height of the plant from base to tip of the tallest tiller in cm.

#### **Number of productive tillers per plant**

Number panicle bearing tillers in a hill.

#### **Panicle length**

The length of panicle from base of the panicle to the tip of grain in cm.

#### **Number of filled grains per panicle**

Total number of filled grains in a primary panicle.

#### **Grain Yield**

Grain yield harvested in a plot in kg and converted for hectare yield.

### **Statistical Analysis**

Analysis of variance was carried out according to Fisher, 1925.

### **Results and Discussion**

The yield and attributes of the cultures viz., days to 50% flowering, plant height, number of productive tillers/plant and grain yield recorded in preliminary yield trial, advanced yield trial I and advanced yield trial II are presented in table 1, 2 &3.

#### **Preliminary yield trial:**

A total of 28 entries along with the checks ASD 16, ADT 43, ADT 45 and TPS 5 were evaluated in replicated yield trials. None of the entries were found to be superior over TPS 5 which recorded a grain

yield of 5988 kg/ha. However the entries TP 10007 ( 5788 kg/ha), TP 10009 ( 5850 kg/ha) , TP 10010 ( 5763 kg/ha) and TP 10008 ( 5988 kg/ha) were found to be on par with TPS 5 and superior over ASD 16, ADT 43 and ADT 45.

**Table 1. Per se performance of rice cultures for yield and yield attributes in PYT**

Sl. o.	Entries	DFP	PH	PT	GY
1	TP 10001	83	87.2	11.1	5113
2	TP 10002	83	92	9.0	5313
3	TP 10003	80	75.3	9.2	4163
4	TP 10004	86	99.3	8.9	4213
5	TP 10005	81	77.3	9.1	5350
6	TP 10006	80	79.1	11.4	5250
7	TP 10007	83	81.6	11.5	5788
8	TP 10008	90	95.6	8.6	5988
9	TP 10009	84	102.1	12.7	5850
10	TP 10010	83	99.7	12.6	5763
11	TP 10011	83	78.9	11	5038
12	TP 10013	84	87	10.7	4413
13	TP 10014	86	92.2	11.7	3613
14	TP 10015	79	86.3	9	4913
15	TP 10016	86	84.8	11.1	3550
16	TP 10017	83	95.4	12.5	4550
17	TP 10018	83	94.2	9.1	4988
18	TP 10035	81	99.9	12.7	4988
19	TP 10037	81	91	13.1	4763
20	TP 10038	85	84.6	12.5	4275
21	TP 10039	80	78.7	9.3	5413
22	TP 10040	83	87.4	13.4	5300
23	TP 10042	80	97.7	10.3	4550
24	TP 10048	81	97.3	10.4	4600
25	TP 10049	81	94.7	11	4238
26	TP 10050	80	95.9	10.2	4250
27	TP 10051	75	94.3	13.4	3575
28	TP 10052	83	83	10.9	1913
29	ASD 16	83	81.7	17.7	4838
30	ADT 43	75	78.9	12.3	4688
31	ADT 45	77	74	11.8	3850
32	TPS 5	90	82.7	9.4	5988
	CD	2.9	12.5	3.1	468.3

### Advance yield trial I:

A total of 15 entries along with the checks ASD 16, ADT 43, ADT 45, ADT 36 and TPS 5 were evaluated in replicated yield trial. The entries TP 08095 ( 7729 kg/ha), TP 08080 ( 7091 kg/ha) , TP 09037 ( 6964 kg/ha ), TP 09046 ( 6851kg/ha), TP 08079 ( 6831 kg/ha) and TP 08053 ( 6739 kg/ha) were found to be superior over TPS 5 which recorded a grain yield of 6425 kg/ha.

**Table 2. Per se performance of rice cultures for yield and yield attributes in AYTI**

Sl. o.	Entries	DFP	PH	PT	GY
1	TP 08003	88	78.3	9.9	6328
2	TP 08006	87	87.6	8.8	6049
3	TP 08024	88	98.3	10.2	6592
4	TP 08053	91	91.8	9.5	6739
5	TP 08079	88	94.2	9.2	6831
6	TP 08080	92	98.6	9.9	7091
7	TP 08095	88	87.2	8.5	7729
8	TP 09028	79	85.5	10.6	6013
9	TP 09037	80	92.8	10.6	6964
10	TP 09046	84	83.5	10.2	6851
11	TP 09047	90	94.3	9	6122
12	TP 09048	76	88.4	10	6368
13	TP 09049	91	103.6	9.6	6744
14	TP 09054	86	84	10.1	6296
15	TP 09055	88	86.1	8.7	6111
16	ADT 36	72	85.7	9.8	5518
17	ASD 16	81	80.3	8.9	5596
18	ADT 43	76	81.7	9.4	4239
19	ADT 45	85	87.9	10.2	5553
20	TPS 5	90	86.3	9.9	6421
	CD	3.2	13.6	3.4	556.3

**Advance yield trial II:**

A total of 15 entries along with the checks ASD 16, ADT 43, ADT 45, ADT 36 and TPS 5 were evaluated in replicated yield trial. The entries TP 08095 (5941 kg/ha), TP 08080 ( 5056 kg/ha) and TP 09037 ( 5124 kg/ha) were found to be superior over TPS 5, ASD 16, ADT 43 and ADT 45.

**Table 3. Per se performance of rice cultures for yield and yield attributes in AYTII**

Sl. o.	Entries	DFP	PH	PT	GY
1	TP 08003	84	92.4	7.2	4222
2	TP 08006	78	107.8	9.6	4422
3	TP 08024	85	106	7.6	3407
4	TP 08053	84	108.4	10.8	4763
5	TP 08079	83	114.4	8.8	3315
6	TP 08080	85	105	11.9	5056
7	TP 08095	85	94.4	13.4	5941
8	TP 09028	76	100	7.8	3808
9	TP 09037	83	104	12.5	5124
10	TP 09046	86	102	11.6	4830
11	TP 09047	86	107.8	10.4	4444
12	TP 09048	81	96	9.8	2639
13	TP 09049	83	111	10.3	4667
14	TP 09054	84	90.2	11.7	4787

15	TP 09055	83	90	11.4	4533
16	ADT 36	79	95	11.2	4426
17	ASD 16	80	100.4	8.6	4974
18	ADT 43	79	94	10	4130
19	ADT 45	79	103	9.2	4373
20	TPS 5	87	105.2	11.4	5074
	CD	4.76	21.11	4.16	598.2

Based on the overall performance the cultures TP 08053, TP 08080, TP 08085 and TP 09037 were found to be superior with consistent performance for yield and other yield attributes over the years. These entries will be evaluated further in MLT and ART and will be released as varieties.

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