Content list available at http://epubs.icar.org.in, www.kiran.nic.in; ISSN: 0970-6429

Indian Journal of Hill Farming

June 2018, Volume 31, Issue 1, Page 165-167

On-Farm Multilocation Adaptability Trial of Promising Rice Genotypes across Manipur

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ARTICLE INFO

Article history:
Received 24 April 2016
Revision Received 29 April 2016
Accepted 30 April 2016

Key words:
Adaptability, multilocation, rice, on-farm, grain yield, variance of deviation

ABSTRACT

An on-farm multilocational trial was conducted at farmers' fields in five districts of Manipur state during *kharif,* 2015 to test the adaptability of two promising advanced breeding lines of rice (RCM-30 & RCM-31) along with two check varieties (CAU R1 & RC Maniphou-10). Pooled analysis of variance for plot yield reflected existence of significant Varietal, Location and Variety × Location interaction suggesting diversity in the testing environments. Rice genotype RCM-30 showed highest yield (51.1 kgs/64 m^2plot) followed by RCM-31(48.9 kgs/plot). Also, the stability parameter, V_i^2 was non-significant for RCM-30 combined with lowest Mean deviation (D_i) depicting the superiority over checks as the most adapted genotype under diverse range of environments.

1. Introduction

Rice is the staple crop of Manipur state contributing to about 98 per cent of total food grains production. During 2014-15, rice production was estimated to be 4.82 lakh tonnes as against the total food grain production of 4.94 lakh tonnes excluding pulses. Average productivity of rice is about 2.5 tonnes/ha. A short fall of about 1 lakh tonne of cereal grains was reported against the estimated requirement of 5.9 lakh tonnes (Anonymous, 2016). Adaptability is ability of the crop variety to perform well over diverse environments. It is the function of both mean productivity and production stability over diverse environments. (Abeysiriwardena *et al.,* 1991). On farm yield trials constitute technology verification experiments wherein adaptability of the promising breeding lines are tested in farmers' field. They are characterised by testing minimum number of genotypes with minimum replicates at the final stage of varietal recommendation in the target region (Gomez and Gomez, 2010). However, larger plot size is used to overcome the heterogeneity within the farmer' fields. Testing in target areas not only provides information on yield but also on the reaction to prevailing biotic and abiotic stresses. Hence, with the objective of identifying promising advanced breeding rice line for valley region with semi glutinous cooking quality for wider adaptability in Manipur, the present on-farm multilocation trial was conducted.

2. Materials and Methods

Based on three years station trial evaluation (*Bhuvaneswari et al*., 2015), two promising semi-glutinous advanced breeding lines RCM-30 and RCM-31 were selected for on-farm testing during *kharif* 2015 along with two popular varieties CAUR1 and RC Maniphou-10 as standard yield checks. Both RCM-30 and RCM-31 were tested in All India Coordinated rice improvement programme (AICRIP), 2014 with code IET 24200 and IET 24206, respectively. The trial was conducted in five locations under farmers' fields *viz.*

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Mana Inkhon village (Imphal West), Chingerel Tejpur village (Imphal East), Thoubal Wangmataba village (Thoubal), Kabowakching village (Bishnupur) and Modi village (Chandel). Standard package of practices were followed under supervision of scientists and subject matter specialists except for biotic stresses. The plot size of 10 m* 10 m of each entry with three replication was maintained in every location. Net plot size of 64 m^2 was used for obtaining yield data. Observation on days to fifty per cent flowering and plot yield were noted across locations. Varietal adaptability was evaluated as per method proposed for on-farm trials in rice by Abeysiriwardena (2001) which is an improvement over Linn and Binn (1988) method for general adaptability testing of rice over diverse environments. Grain yield deviation of each entry (d_{ijk}) was calculated as: Mean of deviation of each replication yield value from maximum value at a particular location

$d_{ijk} = Y_{maxj} - Y_{ijk}$

Combined ANOVA for grain yield and yield deviation was obtained by pooling individual ANOVA across 5 locations after significant varietal difference was observed. Mean deviation across locations for each variety (D_i) was obtained by the formula

$D_i = \sum^{n}_{j=1} d_{ij.}/n$ where, n=no. of locations

Variance in deviations (V_i^2) for each variety,

$V_i^2 = [\sum d^2_{ij.} - \sum (d_{ij})^2/n]/q(n-1)$

All the calculations were done using Microsoft excel. Also, the disease incidence of major diseases viz., neck and leaf blast was noted down as per standard evaluation system of IRRI, (SES, 1996).

3. Results and Discussion

Results of combined analyses of variance on grain yield data and plot yield deviations (Table 1) depicted Mean Sum of Squares (MSS) due to location is highly significant indicating that the locations used in the study have a diverse environment which is prerequisite for varietal adaptability evaluation. The varietal performances also differed significantly across locations due to presence of significant Varietal * Environment interaction. The plot deviations also differ significantly for varieties, locations and showed significant interaction between varieties and Location. Least square difference (LSD) performed on mean deviations (D_i) and stability parameter (V_i^2) on each variety indicated varieties, RC Maniphou-10 and CAU R1 showed significant plot deviations as compared to new genotypes RCM-30 &RCM-31. When the varietal deviations were examined for specific adaptability, RCM-30 performed with highest yield in the four valley districts whereas RCM-31(41.1 kgs /plot) was highest yielding in the hill district (Chandel). However, RCM-31 performance was lower and deviations were significant in valley region. Thus RCM-31 was inferior on the basis of poor general adaptability. In order to select the best genotype considering both yield and stability parameter (Table 2), least square difference (LSD) for grain yield from mean value showed that both RCM-30 and RCM-31 are on par and significantly high yielding as compared to both the check varieties. However, for stability parameter, RCM-30 showed least Deviation (D_i) and non-significant V_i^2. Along with yield data, observations were also recorded for disease tolerance for entries across locations, both RCM-30 and RCM

Table 1. Combined Analysis of Variance for grain yield and Plot yield deviations of four rice genotypes tested across five locations of Manipur

Source	df	MSS
Grain yield(kg/plot)		
Replications within locations	10	5.263
locations(L)	4	1008.962**
variety	3	668.462**
location* variety	12	32.060**
Pooled error	30	1.722
total	59	
Plot Yield deviations		
Replications within location	10	4.437
locations	4	34.006**
varieties	3	505.442**
variety* location	12	24.628**
Pooled Error	30	1.026
Total	59	

-31 were least affected by blast (leaf and neck) disease which is prevalent in Manipur whereas CAUR1 was affected by neck blast disease across locations. RCM-30 and RCM-31 are derived from cross KD-2-6-3 and *Akhanphou.* The parent *Akhanphou* is a potential landrace of Manipur which contains two QTLs qLNBL 5 and qLNBL 7 conferring durable field resistance to leaf as well as neck blast (Aglawe B S *et al*., 2017). However, the presence of the QTLs in RCM-30 need to be validated. RCM-30 being medium duration, semi-glutinuous, tolerant to blast disease and widely adapted may be recommended for general cultivation in the valley region of Manipur state under transplanted conditions of Main *kharif* season.

Table 3: Mean Deviations(Di) and Stability parameter (V_i^2) of four rice entries tested

Rice Entry	Mean Yield(t/ha)	Mean deviation (D_i)	Variance of deviation (V_i^2)
RCM -30	7979.0[a]	2.8 [b]	7.4901
RCM-31	7643.6[a]	5.0 [b]	33.4218*
CAU R1	6168.0[b]	14.4 [a]	160.995*
RC Maniphou-10	5945.3[b]	16.1[a]	63.5723*

RCM 30

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