Available online at www.ijpab.com
DOI: http://dx.doi.org/10.18782/2320-7051.2746
ISSN: 2320 – 7051
Int. J. Pure App. Biosci. **5 (2):** 427-432 (2017)
International Journal of Pure & Applied Bioscience
Research Article
OPEN ACCESS

Rationales of National, Regional and Local Checks to Gauge Mid-Early Rice Genotypes in Southern Chhattisgarh

Prafull Kumar[1*], R. S. Netam[1], P. K. Salam[1] and D. P. Patel[2]
[1]S. G. College of Agriculture and Resaerch Station, Jagdalpur, IGKV, Raipur, CG, 494001
[2]College of Agriculture and Research Station, Kanker, IGKV, Raipur, CG, 494334
*Corresponding Author E-mail: prafull397@gmail.com
Received: 24.03.2017 | Revised: 6.04.2017 | Accepted: 8.04.2017

ABSTRACT

The biannual experiment was undertaken in SGCARS, Jagdalpur, Indira Gandhi Krishi Vishwavidyala, Raipur, CG, India, during Kharif 2012-13 and 2013-14 to validate the significance and validity of local check variety to screen medium duration rice genotypes. Beginning from National check (IR 64), six entries recorded at par results namely CR-2706 (4875kg/ha), CN 1446-5-8-17-1-MLD 4 (4917 kg/ha), NP-124-8 (5722 kg/ha), CR-2641-26-1-2-2 (5750 kg/ha), NK 6303 (4967 kg/ha) and KPH 371 (5656 kg/ha) including the local check (5431 kg/ha) in Kharif 2012-13. We can interpret that approximate 35 percent genotypes were allowed to proceed. In subsequent experiment i.e. Kharif 2013-14, the four checks namely hybrid check (US 312); National Check (IR-64); Regional check (Lalat) and local check (Chandrahasini) found to be good standard to identify test entries with 4231, 3821, 4564 and 4154 kg/ha yield respectively. Lalat, the regional check (Eastern), had higher yield and phenotypic acceptability and only five entries (UPRI 2012-18, MTU 1056, RH 664, BPH 115, and CN 1752-18-1-9-MLD 19) could go beyond. Similarly, HKR 08-62 (4467 kg/ha), US 312 (4231 kg/ha), UPRI 2012-18 (4615 kg/ha), OR 1929-4 (4744 kg/ha), MTU 1056 (4718 kg/ha), Lalat (4564 kg/ha),RH 664 (5000 kg/ha), BPH 115 (4756 kg/ha), CN 1752-18-1-9-MLD 19 (5833 kg/ha) and HKR 08-83 (4487 kg/ha) found to be superior to local check. National check (IR 64) and regional checks (Lalat) were found suitable; however since many new comparative varieties have been released so far, further review necessitated. Regarding local check, Chandrahasini is quite phenotypically acceptable option to screen mid-early duration rice varieties for Southern Chhattisgarh region.

Keywords: *Mid Early Rice, Local Control, Variety Release, Chandrahasini.*

INTRODUCTION

Rice is a staple food crop of more than one third of world's populace. Being major source of energy and carbohydrates, it provides 20% of the world's dietary energy supply, in comparison to wheat and maize which shares 19 percent and 5 percent respectively[4].

Cite this article: Kumar, P., Netam, R.S., Salam, P.K. and Patel, D.P., Rationales of National, Regional and Local Checks to Gauge Mid-Early Rice Genotypes in Southern Chhattisgarh, *Int. J. Pure App. Biosci.* **5(2):** 427-432 (2017). doi: http://dx.doi.org/10.18782/2320-7051.2746

Rice is cultivated in diverse environments ranging from upland hills to deep water and probably still maintains larger variability than other crops with respect of crop ecology[7]. The water requirement of rice is twice to thrice greater than other cereals[12]. Traditional rice production ecosystems (irrigated puddled transplanted) require an average of 2500 liters of water to produce 1 kg grain[1]. Reports reveal that about 50 percent of available fresh water in Asia is diverted to rice cultivation[2] and this has become challenge to crop geneticist and breeders. The water scarce crisis become more severe when majority of farmers adopts puddled transplanted system in both irrigated and rainfed rice ecosystems grow rice regardless of the topography and availability of irrigation water[11]. Higher water requirements of rice are due to puddling, seepage and percolation losses associated with continuous flooding. Long durational rice varieties namely MTU 1001, Mahsuri, Swarna, Jaldubbi etc. have good yield potential and hence higher water requirement is justified with crop growth length however, yield is quite lower in early and vary early varieties because of small growth span. Further, consistently decreasing water resource calls for mid durational rice genotypes which can bridge up between vary early and lengthy group.

Three basic principles are followed to conduct experiment i.e. replication, randomization and local control or check (LC) of which first two components are unambiguously adopted among researchers to evaluate genotypes with varietal release and regional objectives. However choice of local check, the best locally adopted variety, is difficult task particularly for beginners or young workers, where merely improper selection of LC leads to misinterpretation of results and loss of some potent breeding materials. Highlighting the variety release programme either All India Coordinated Crop Research Programmes (AICRPs), State level release or pre-release trials, check variety is base data to promote or reject test entry. Review of previous works could not generate significant information regarding the suitability of checks in crop breeding experiment therefore, experiment was planned to generate basic data for youngsters and extend attention of scientific forum towards nanoscopic but equally considerable aspect of field study.

MATERIALS AND METHODS

The experiment was conducted in Shaheed Gundadhoor College of Agriculture and Research Station, Jagdalpur, Chhattisgarh during the *Kharif* 2012-13 and 2013-14 to evaluate the mid durational rice genotypes for suitability and adaptability at plateau agriculture. The test genotypes were obtained from DRR, Hyderabad (now ICAR-Indian Institute of Rice Research) under All India Coordinated Rice Improvement Programme. 20 and 17 advanced generation breeding materials were evaluated in Randomized Complete Block Design with three replications in both experimental seasons respectively. The plot size was maintained at 5x3sq M (gross basis) and 5x2.6sq M (net basis). The four checks namely hybrid check (US 312); National Check (IR-64); Regional check (Lalat) and local check (*Chandrahasini*). The seedlings were planted by 21 DAS and remaining standard agronomic package was followed to get optimum plant population. Looking for statistical background quartet selection measure was followed with four quantitative parameters viz., plant height (cm), days to 50 percent flowering, panicles per square meter and yield per plot (kg). For statistical interpretation of obtained data IASRI software package SPARK 2 was deployed.

RESULTS AND DISCUSSIONS

Experimental Year I (*Kharif* 2012-13)

Rice crop is highly sensitive to soil and ambient moisture stress and high/low temperature stresses at pre and post reproductive phase. Yield losses due to reproductive-stage drought stress are most severe in the Orissa, Chhattisgarh, Jharkhand and Bihar, which are major rice-producing states of eastern India[10]. The higher frequency and intensity of drought spells necessitates the development of rice varieties, which can survive under water deficit stress at reproductive stage and quick drought recovery as well, by rapid growth upon improved availability of soil moisture[6,8]. Analysis of variance revealed sufficient variation for all traits under study to carry out crop breeding experiment. Beginning from National check (IR 64), six entries recorded at par results namely CR-2706 (4875kg/ha), CN 1446-5-8-17-1-MLD 4 (4917 kg/ha), NP-124-8 (5722 kg/ha), CR-2641-26-1-2-2 (5750 kg/ha), NK 6303 (4967 kg/ha) and KPH 371 (5656 kg/ha) including the local check (5431 kg/ha) (**Table 01**). We can interpret that approximate 35 percent genotypes were allowed to proceed. The regional check for Eastern India, *Lalat*, produced 3944 kg/ha experimental grain yield and fifteen test entries recorded greater values; but the local check, *Chandrahasini*, let only three genotypes i.e. KPH-371, CR-2641-26-1-2-2 and NP-124-8 to document superior crop harvest and moreover KPH-371 is hybrid cultivar. Regarding panicles population, trial mean was 235 and 258, 261 and 206 count was noted for National, Regional and local checks respectively. Only one genotype (UPR-3425-11-1-1) exhibited superior performance to National and Regional checks however, it doesn't attributes to genotypic inferiority since panicle length and spikelet size and weight can supplement to final produce and therefore, in present treatment, panicle numbers did not correlated with grain yield significantly positive. Days to fifty percent flowering ranged between 92 DAS to 109 DAS and checks lied at 95-107 DAS. *Chandrahasini* took more than average population to produce fertile flowers and only UPR-3425-11-1-1 attained the phase next to LC which advocates its further validation. With respect to regional check, KPH 371 (92 DAS), IR-78091-6-2-3-1 (93 DAS) and NDR 370133 (92 DAS) flower earlier to regional check and similarly nine genotypes recorded to early flowering to National Check. We recorded plant height within 85-116cms and both extremes were shared by RC and NC respectively. *Chandrahasini* exhibited 88cms upper canopy growth and produced more than 50 Qt/ha yield therefore, ascribed to more contribution reproductive units. Five entries lied near to NC vis-à-vis plant height namely CR-2706 (108cm), CN 1446-5-8-17-1-MLD 4 (101cm), NVSR-178 (104cm), R-1535-1382-1-1667-1 (107cm), NK 6303 (100cm); NDR 370133 placed close to RC and LC and remaining ones scattered between.

The basic idea of National check is, when test entry performs 10 percent better in terms of grain yield or economic produce, it can be shifted to subsequent trials or proposed for varietal release at National level and similarly if genotypes performs superior to regional scale, can be released for the particular region only. The purpose of local check or local control, the basic ingredient of any experiment after replication and randomization, is to assess micro environmental play and genotypic suitability to given environment. Further it also justifies the significance of evaluation at given location. Hence, prime importances of using vary proper check variety to accurately review the varietal performance particularly in crop improvement experiments. In present experiment, most of entries outperformed the check varieties but it's not worthy to question the basic experimental component since the crop yield is significant for mid duration. Further, all the test genotypes is in Advanced Varietal Trial-2 (AVT 2) stage and have already undergone two tier screening i.e. Initial Varietal Trial (IVT) and Advanced Varietal Trial-1 (AVT-1), therefore only superior entries were included.

Experimental Year II (*Kharif* 2013-14)

The four checks namely hybrid check (US 312); National Check (IR-64); Regional check (Lalat) and local check (Chandrahasini) found to be good standard to identify test entries with 4231, 3821, 4564 and 4154 kg/ha yield respectively. The average of grain yield among checks were found to be 4192kg/ha while population mean was recorded as 4370kg/ha; which further signifies the suitability of checks to screen the population. IR 64, the National check, had yield superiority over six genotypes whereas eleven genotypes *viz*., HKR 08-62 (4487 kg/ha), UPRI 2012-18 (4615 kg/ha), OR 1929-4 (4744 kg/ha), MTU 1156 (4718 kg/ha), Lalat (4564 kg/ha), RH 664 (5000kg/ha), BPH 115 (4756 kg/ha), CN 1752-18-1-9-MLD 19 (5833 kg/ha) and HKR 08-83 (4487 kg/ha) recorded higher yield. Lalat, the regional check (Eastern), had higher yield and phenotypic acceptability and only five entries (UPRI 2012-18, MTU 1056, RH 664, BPH

115, and CN 1752-18-1-9-MLD 19) could go beyond. Similarly, HKR 08-62 (4467 kg/ha), US 312 (4231 kg/ha), UPRI 2012-18 (4615 kg/ha), OR 1929-4 (4744 kg/ha), MTU 1056 (4718 kg/ha), Lalat (4564 kg/ha),RH 664 (5000 kg/ha), BPH 115 (4756 kg/ha), CN 1752-18-1-9-MLD 19 (5833 kg/ha) and HKR 08-83 (4487 kg/ha) found to be superior to local check, *Chandrahasini*. The plot flowering and maturity stages also revealed more or less similar pattern to plant height (**Table 01)**.In general perception, plant height decreases with increasing soil moisture stress, might be due to inhibition of cell division or cell enlargement under water stress[9,14] or *vise versa*. However, in present investigation, since the medium duration genotypes ware undertaken under irrigated condition, variation in plant height among the genotypes indicates that different genotypes had different water requirement. Regarding sink strength and population, Lalat was found to be comparative superior (308) over other checks i.e. 212 in national check and 276 in local check. With respect to regional check, US 312 (326), UPRI 2012-18 (337), MTU 1156 (309), HKR 08-92 (318), RH 664 (311), CN 1752-18-1-9-MLD 19 (337) and Bio-452 (327) had higher panicle population which shows the basis of yield superiority. Days to flowering is very critical to assess the appropriateness of checks because delayed flowering brought about by lengthy vegetative growth span increase the grain yield invariability or *vise varsa*. However, in such case, test genotypes would easily outshine or under shine than checks and that would mislead the results. The average experimental flowering span was 101 DAS while the checks bloomed by 95 DAS, 99 DAS and 95 DAS (National, Regional and Local respectively). Beginning from National check, all the genotypes flowered late except local check (93 DAS). Lalat was found to be good genotype to screen medium genotypes and among, nine entries flowered late *viz*., HKR 08-62 (107 DAS), US 312 (106 DAS), HKR 08-92 (112 DAS), RP 3564-1-1-1-1 (106 DAS), RH-664 (104 DAS), BPH-115 (106 DAS), CN 1752-18-1-9-MLD 19 (107 DAS) and HKR08-83 (108 DAS) and six recorded early. The local check found to be earliest among all and took only 93 DAS to get 50 percent plot flowering. As per theoretical background earliness in blooming period reduces the grain yield due to reduced sink capacity, but it was not observed is present experimental material and in 93 DAS and 99 DAS flowering span genotypes the final yield was comparable. The high yield of rice is attributed to the increased number of spikelets per panicle. Wu et al., [13] observed that the total higher spikelet number resulted in increased grain yield in super rice. The main strategy to enlarge the sink capacity was to increase the number of spikelets per panicle. Increases in primary branches number and spikelets on the primary and secondary branches contribute to the large sized panicles i.e. sink strength increased. To maximize the yield of medium duration rice, appropriate panicle number, larger panicles, greater spikelet number, and greater source and sink capacity, stable grain filling efficiency, and super high-yielding potential should be manipulated by breeding and/or crop management[3,5] .

Conclusively, local check is prerequisite for any statistically designed experiment and its mandatory to select suitable check variety to screen the genotypes. Appropriateness of check is pooled criteria of many factors such as days to anthesis, crop duration, and morphophysiological adaption to particular biotic and abiotic stress and over all crop yields. For screening medium early duration genotypes, the local check should exhibit anthesis by 85-90 DAS accomplish crop growth cycle by 115-120 DAS and crop yield 35-40 Qt^{-1}. Further, medium duration rice variety suffers from gall midge and brown plant hopper incidence therefore, the check should be moderately resistant as a minimum. Precedencely, the selection pressure laid by local check should be approximate 50 percent i.e. at least half of test genotypes can qualify theoretically. National check (IR 64) and regional checks (Lalat) were still found to be suitable for rice growing category however it further need to be reviewed since many new comparative varieties has been released so far. Regarding local check, *Chandrahasini* is quite phenotypically acceptable option to screen mid-early duration rice varieties for Southern Chhattisgarh region.

Table 1: Biannual ancillary trait data including National, Regional and Local Check

Genotypes	***Kharif* 2012-13**					Genotypes	***Kharif* 2013-14**				
	PH	DF	P/Sq M	Yield (Kg/plot)	Yield (kg/ha)		PH	DF	P/Sq M	Yield (Kg/plot)	Yield (kg/ha)
IR 64 (NC)	116	101	258	5.29	4406	HKR 08-62	94	106	290	5.83	4487
CR 2706 (IR 84895-B-CRA-171-32-1-2-1)	108	105	210	5.85	4875	US 312 (Hybrid check)	94	106	326	5.50	4231
NDR 370133	89	92	250	4.42	3681	UPRI 2012-18	109	99	337	6.00	4615
CRR 624-207-B-1-B	90	98	257	5.09	4242	OR 1929-4	99	99	293	6.17	4744
UPR-3425-11-1-1	93	109	266	3.50	2917	RP 5212-41-4-3-1-1-1-B	93	98	291	4.77	3667
UPR-3413-8-2-1	93	98	252	5.30	4417	IR 64 (NC)	92	95	212	4.97	3821
CN 1446-5-8-17-1-MLD 4	101	103	210	5.90	4917	MTU 1156	90	96	309	6.13	4718
NVSR-178	104	106	225	5.27	4389	HKR 08-92	93	112	318	4.77	3667
IR-78091-6-2-3-1-1	90	93	228	5.10	4253	CR 3564-1-1-1-1	92	106	294	5.02	3864
NP-124-8	96	111	254	6.87	5722	Lalat (RC)	107	99	308	5.93	4564
ORS-327	87	96	222	4.32	3597	RH-664	91	104	311	6.50	5000
R-1528-1058-1-110-1	94	105	232	5.33	4444	BPH-115	98	106	295	6.18	4756
R-1535-1382-1-1667-1	107	99	209	3.43	2861	CN 1752-18-1-9-MLD 19	98	107	337	7.58	5833
CR-2644-2-6-4-3-2	95	104	258	5.04	4197	Bio-452	102	95	327	5.10	3923
CR-2641-26-1-2-2	92	107	179	6.90	5750	Chandrahasini (LC)	85	93	276	5.40	4154
Lalat (RC)	85	95	261	4.73	3944	CN 1757-5-3-7-MLD 18	91	95	298	4.90	3769
Chandrahasini (LC)	88	107	206	6.52	5431	HKR08-83	85	108	239	5.83	4487
PA 6201 (Hybrid Check)	89	106	256	4.90	4083						
NK 6303 (Hybrid)	100	109	240	5.96	4967						
KPH 371 (Hybrid)	93	92	218	6.79	5656						

Acknowledgement

The authors acknowledges the financial and technical support provided by ICAR-IIRR (Indian Institute of Rice Research), Hyderabad, India, for providing financial and technical support.

REFERENCES

1. Bouman, B.A.M., Humphreys, E. Tuong, T.P. Barker, R.and Donald. L.S., Rice and water. *Advances in Agronomy* **92**: 187-237(2007).
2. Brian Barker et al., "Monitoring Nuclear Tests", Science, Vol. 281, 25 September 1998, pp. 1967-68 (1998).
3. Chen, Y. M., Yield structure and super high-yielding techniques in super rice. *Acta Agric Jiangxi* **20(2)**: 20–22 (2008) (in Chinese).
4. FAO, "Rice is Life". Food and Agricultural Organization of the United Nations. (2004).
5. Jing, F. and Jian-chang, Y., Research Advances in High-Yielding Cultivation and Physiology of Super Rice. *Rice Science* **19(3)**: 177−184 (2012).
6. Kamoshita, A., Babu, R.C., Boopathi, N.M., Fukai, S., Phenotypic and genotypic analysis of drought-resistance traits for development of rice cultivars adapted to rain-fed environments. *Field Crop Res* **109**: 1-23 (2008).
7. Kumar, Prafull., Sao, A., Kanwar, R. R., Mukherjee, S.C., Kumari, P., Determining Cause effect relationship among yield and yield components in upland rice (*Oryza sativa* L.) genotypes. *Indian Journal of Hill Agriculture* **7 (1)**: 80-83 (2016).
8. Kumar, Prafull., Sao, A., Kanwar, R. R. and Salam J, L., AMMI Biplot analysis and Genotype x Environment interaction studies in rainfed upland rice accessions. *Oryza* **52 (1)**: 27-33 (2015a).
9. Kumar, Prafull., Sao, A., Mukherjee, S. C. and Netam, R. S..Secondary genetic productivity factors (SGPFs) in expression of grain yield in rainfed upland rice of Bastar Plateau. *Asian journal of bio science* **10 (2)**: 164-168 (2015b).
10. Kumar, S., Dwivedi, S. K., Singh, S. S., Jha, S. K., Lekshmy, S., Elanchezhian, R., Singh, O. N. and Bhatt, B.P., Identification of drought tolerant rice genotypes by analysing drought tolerance indices and morpho-physiological traits. SABRAO *Journal of Breeding and Genetics* **46 (2)**: 217-230 (2014).
11. Kushwaha, U.K.S., Khatiwada, S.P., Upreti, H.K., Shah, U.S., Thapa, D.B., Dhami, N.B., Gupta, S.R., Singh, P.K., Mehta, K.R., Sah, S.K., Chaudhary, B., Tripathi, B.P.. Modification of Rice Breeding Technology in 21st Century.*International Journal of Bioinformatics and Biomedical Engineering* 1, (2): 77-84 (2015).
12. Tuong, T.P., B.A.M. Bouman, and M. Mortimer., More rice, less water—integrated approaches for increasing water productivity in irrigated rice-based systems in Asia. *Plant Prod. Sci* **8**: 231–241 (2005).
13. Wu, W. G., Zhang, H. C., Wu, G. C., Zai, C. Q., Qian, Y. F., Chen, Y., Xu, J., Dai, Q. G., Xu, K., Preliminary study on super rice population sink characters. *Sci Agric Sin*., **40(2)**: 250–257 (in Chinese with English abstract) (2007).
14. Zubaer, M.A., Chowdhury, A.K.M.M.B., Islam, M.Z., Ahmed, T. and. Hasan, M.A., Effects of Water Stress on Growth and Yield Attributes of Aman Rice Genotypes. *Int. J. Sustain. Crop Prod* **2(6)**: 25-30 (2007).