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Choice of stable rice genotypes for fragile environment

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ABSTRACT

Traditional rainfed lowland varieties are poor yet stable .Therefore twelve elite low land genotypes were evaluated for stability analysis. NDR 30039, NDR 30030 and NDR 30076 recorded high stability, both at cultivator fields and on station. Three genotypes had common ancestry and hence the differences in the genotypes could be only in maturity duration. NDR 40012 and NDR 40013 selected from different parentage, gave higher yields but differed in their stability levels.

Key words: *Stability analysis, grain yield, lowland rice*

Rainfed lowland ecosystem is the second most importance after irrigated rice ecosystem which accounts for about one-fourth of total world's rice area. Rainfed lowland are bonded and impound with rain-water. There is a great diversity in the system for growing conditions that very by duration, depth of standing water, flooding frequency, soil types and topography. The rainfed lowland of eastern U.P. and part of Bihar of India frequently suffer from early drought, which makes it difficult to work out optimum sowing/transplanting time in rice. Contrasting situation also exists where rice crop get submerged by heavy rainfall and water accumulation in the fields. Some rainfed lowland areas are also prone to drought as well as submergence. The diversified ecosystems thus demand for rice varieties with high adaptability to such environmental fluctuations for stable rice production. The present paper describes the results of investigation undertaken to study recommendation domains for genotypes in the fragile rainfed lowland ecosystem.

Twelve lowland genotypes, identified lowland, were evaluated in completely Randomized Block Design with three replication at Crop Research Station, Masodha, Kumarganj and Ghaghradhat of N.D. University of Agriculture & Technology, Faizabad, Uttar Pradesh. The genotypes were grown in 15 m^2 plot with the spacing 20 x 15 cm. Fertilizer was applied at the rate of 80:40:40 kg of NPK ha^{-1}. Water depth during crop growth (transplanting to flowering) varied from 20 to 60 cm. The same set of genotypes was tested at different cultivators field, in order to confirm their potential and adaptability.

The pooled analysis of variance indicated significant amongst genotypes. Environment variation, its component and genotypes-environment interaction were highly significant for all traits. Stability parameters such as Mean (X), regeneration co-efficient (bi), deviation from regression (s^2di) were considered for interpretation of results for on-station trails whereas co-efficient of variability (C.V.%) was used for on-farm trails.

Based on stability parameters, the genotypes could be divided into three distinct groups. The group, with NDR 30039 and NDR 40012, had high yields (6.42 and 6.50 t ha^{-1}) and high regression coefficient indicating their high responsiveness to favourable environment. The second group consisting of NDR 30030 and NDR 30076 high yielded >6.0 t ha^{-1} but their regression coefficient was 1.0, thus appear to be suitable for a wide range of environment of rainfed lowland ecosystems, and therefore, are the best substitute for existing varieties like Madhukar and Sabita which are stable yet poor yielder. The rest of genotypes in Table 1 had unpredictable behavior. Their performance changes with the change in the growing conditions.

The twelve genotypes along with 3 checks were also tested under On-farm conditions for two successive

Table 1. Analysis of stability of rain yield (t ha^{-1}) under on-station and on-farm trails

Genotypes	On-station trails			On-farm trails	
	$\overline{X}$ (t ha^{-1})	bi	S^2di	X t ha^{-1})	C.V.*
NDR30039	6.42	1.54	NS^{+}	6.1	23.1
NDR30030	6.17	1.07	NS	5.8	18.7
NDR30076	6.00	1.08	NS	6.2	37.5
NDR40013	5.42	0.86	**	5.6	32.6
NDR40023	5.30	0.64	**	4.1	36.2
NDR30073	4.36	0.36	**	4.3	41.6
NDR40012	6.55	1.68	NS	5.7	28.6
NDR30032	4.18	0.98	**	4.0	40.5
NDR30023	3.62	0.76	**	2.9	38.7
NDR40032	3.85	0.62	**	4.6	36.6
NDR40080	4.68	0.98	**	3.1	29.6
NDR30078	4.62	0.86	**	3.6	34.6
Mahsuri	3.60	0.32	**	3.2	31.5
Sabita	2.86	0.67	NS	2.7	34.5
Madhukar	1.75	0.48	NS	1.5	19.7

+ = NS, Non Significant: * = C.V. Co-efficient of variation and ** = Highly significant

year on cultivators' field (Table1). All new slection except NDR 30023 (2.9 t.ha) yielded more than checks Mahsuri (3,2 t ha^{-1}), Sabita (2.7 t ha^{-1}) and Madhukar (1.5 t ha^{-1}). NDR 30030 (5.8 t ha^{-1}), NDR 30039 (6.2 t ha^{-1}), NDR 30076 (5.7 t ha^{-1}) and NDR 40012 (5.7 t ha^{-1}) had high grain yields and low levels of coefficient of variation. NDR 40013which although had high grain yield (5.6 t ha^{-1}), does not seem to be suitable for such an erratic and uncertain ecosystem, due to high level of coefficient of variation (32.6%).

The high yielding genotypes NDR 30039, NDR 30030 and NDR 30076 apart from their responsiveness, show high stability, both at cultivators' field and on-station conditions. Since these genotypes were obtained from same ancestry, the major differences were their maturity duration, which of course is a prime factor under rainfed ecosystem. NDR 40012 and NDR 40013 selected from different parentage, gave higher yields but differed in their stability level under two conditions. At cultivators' farm their yields varied drastically unlike the on-station trials. Results indicated that evaluation sites must include the target environment before the genotypes are finally selected for general cultivation.

Institutional breeding has limitations to adequately meet the needs and requirements of risk prone rainfed lowland environments. This stems largely from the fact that breeding is mainly directed at increasing yield in more favorable environment, and selection are frequently made on stations with near optimum conditions. The conditions vary from the circumstances of small farmers in rainfed environments (Basilio, 1996). It is therefore necessary to test the breeding lines on the farmers' fields before the final selection and release for cultivation. The participatory varietal selection studies confirm our finding (Courtois *et. al.*, 2001).

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