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Original Research Article

Nutrient Requirements of Recently Released Rice Varieties and Hybrids in Faizabad

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A B S T R A C T

The results of the study conducted at Faizabad with different test cultures and different combination of nutrient application indicated differential response of genotypes to nutrient application and test environment with reference to yield and nutrient accumulation. Overall, the yield response was significant up to 180 kg N at DRR, 180:60:50 kg NPK at Faizabad. Among the test cultures hybrid US 312 was most productive at DRR and PAC 835 at Faizabad, while IET 19574 was promising among the HYVs at majority of the locations recording higher nutrient content in the dry matter. Average recovery efficiency of applied nutrients varied with the locations from nil - 60% for N, nil -13% for P and nil - > 100% for K. Based on the nutrient accumulation and yield response to fertilizer application, the estimated nutrient uptake requirements for the highest yields of hybrids and HYVs across the locations ranged from 16 – 33 kg N, 5-9 kg P_2O_5 and 15 – 41 kg K_2O per ton of grain production and was unusually very high at Faizabad. Among the test cultures nutrient requirement for hybrids was less compared to HYVs at all the locations

Keywords

Nutrient requirements, rice varieties, Hybrids

Introduction

Nutrient application in right proportions to meet the growth requirements of a genotype is vital for realizing the yield potential of modern high yielding varieties (Dai *et al.*, 2006, Kumar *et al.*, 2003). Release of varieties and hybrids of high yield potential with varied yield expression under different growing environments warrants precise assessment of nutrient requirements of such varieties for arriving at the fertilizer prescriptions to ensure harvestable yield potential on sustainable basis besides optimizing input use (Nayak *et al., 2003*, *Rai, 2006*, Rajarathinam, and Balasubramaniyan, 1999*)*. The trial was, therefore, conducted at two locations (DRR and Faizabad) in *kharif* 2011 to assess the requirements of all major nutrients (NPK) of recently released varieties and hybrids (two each) of mid early to mid-duration group grown under different environments.

The varietal responses to a combination (8) of nutrient levels (0, 60,120 and 180 kg N, 0, 30 and 60 kg P_2O_5, and 0, 50 and 100 kg K_2O/ha) and nutrient accumulation in the dry matter under standard cultural practices were recorded. The genotypes selected for the study were US 312 (Hybrid), PAC 835 (Hybrid), IET21045 and IET 19574 which

have been released for their high yield potential and resistance to biotic stresses.

Materials and Methods

To assess the productivity and major nutrient (NPK) requirement of recently released varieties / hybrids in specific regions under irrigated conditions based on their response to applied nutrients and nutrient accumulation in the dry matter for developing fertilizer management package.

Results and Discussion

Rice productivity and Nutrient uptake

The data on rice and straw yields and Nutrient uptake is presented in the Table 1 show differential genotype responses to environments and nutrient application. Average productivity of rice at the test locations ranged from 3.1 – 6.4 t/ha highest being recorded under semi-arid irrigated conditions at DRR.

Interaction effects of genotypes and nutrient application were significant at DRR and Faizabad. Hybrids yielded more than the HYVs by 25 - 43%. Response to nutrient application was location specific, to an extent reflecting soil and crop growing environment.

Mean yields increased significantly up to 180 kg N at DRR, 180:60:50 kg NPK at Faizabad. Genotypes which responded differentially to nutrient application at the test locations (significant interaction effects) recorded highest yields at 180:60:100 kg NPK at Faizabad and DRR, while IET 21045 and IET 19574 did not respond to P application at DRR. Among the test cultures hybrid US 312 was most productive at DRR and PAC 835 at Faizabad. The highest yielding nutrient treatment for each genotype and location was selected for working out the nutrient requirements based on the nutrient accumulation. Straw yield trends apparently followed that of grain yield with regard to nutrient application.

Nutrient accumulation in the total dry matter at harvest reported from all the locations (Table 1). Mean N uptake ranged from 59 – 118 kg/ha and that of P and K were, respectively 23 – 43 and 65 – 148 kg/ha. Genotypes differed in their capacity to accumulate nutrients with hybrids in general recording higher uptake of nutrients in the dry matter over HYVs.

Among the genotypes PAC 835 at Faizabad and US 312 at DRR recorded higher nutrient content in the dry matter while IET 19574 was superior among HYVs for all the major nutrients. Uptake of nutrients varied with nutrient application levels and their combinations at both locations, recording increasing accumulation of N up to 120 kg/ha at DRR, and up to 180 at Faizabad, of P uptake up to 60 kg/ha at Faizabad. Similarly K uptake at Faizabad improved up to 50 kg/ha while at DRR there was no increase in P and K uptake in the dry matter with external application. Based on the nutrient uptake data average applied fertilizer recovery was estimated which ranged from nil - 60% for N, nil -13% for P and nil to > 100% for applied K. The values recorded at Faizabad show a large deviation from reported values.

Nutrient requirement

Based on the uptake of nutrients recorded at the highest yields of each variety and location, nutrient requirement (kg nutrient uptake/ton grain) was estimated (Table 2). The test genotypes accumulated nutrients differentially reflecting broadly the location environment and genotype yield potential.

Treatments: Main plot (4): – Varieties (Sub plots) (8): Nutrient levels

Treatment Number	Treatment details
Main plots Varieties (4):	1. IET 20727 (US 382), 2. IET 20759 (JKRH 3333), 3. IET 22081, 4. IET 21542
Sub plots	Nutrient levels
1	N0 P60 K100
2	N120 P0 K100
3	N120 P60 K0
4	N60 P60 K100
5	N120 P30 K100
6	N120 P60 K50
7	N120 P60 K100
8	N180 P60 K100

N levels – 0, 60,120,180 kg N/ha (0, 0.5,1.0,1.5); P levels – 0, 30, and 60 kg P_2O_5 /ha (0, 0.5,1.0); K levels – 0, 50, and 100 kg K_2O /ha (0, 0.5,1.0)

Replications: 3 Design: Split plot; Plot size: 20 m2 Spacing: 20 x 10 or 20x15 cm depending on the duration of the variety

Table.1 Nutrient requirements of recently released rice varieties and hybrids, *kharif* 2011 Grain and straw yield (kg / ha)

Treatment	**Grain yield (kg/ha)**		**Straw yield (kg/ha)**		**Nitrogen (N)**	**Phosphorus (P_2O_5)**	**Potassium (K_2O)**	**Nitrogen (N)**	**Phosphorus (P_2O_5)**	**Potassium (K_2O)**
	DRR	**Faizabad**	**DRR**	**Faizabad**	**DRR**			**Faizabad**		
Varieties										
US 312	3771	4870	7449	4895	76.78	2.70	41.05	75.24	21.95	30.59
PAC 835	4306	4807	6366	4649	79.59	2.96	44.52	64.12	25.94	25.70
IET 21045	3600	4485	6937	4810	83.70	2.37	42.30	59.63	27.14	23.87
IET 19574	5336	4293	7582	4383	124.96	3.14	48.30	57.15	23.79	23.56
Nutrients										
CD (0.05)	ns	104.8	Ns	148	34.19	ns	Ns	3.08	3.08	0.61
CV (%)	43.35	3.21	26.44	4.49	53.04	60.74	27.56	6.80	6.80	3.31
$N_0P_{60}K_{100}$	4339	4087	6708	3924	93.57	3.10	41.30	25.36	58.13	23.59
$N_{120}P_0K_{100}$	4370	4383	7441	4262	98.56	2.96	45.99	26.17	68.05	25.08
$N_{120}P_{60}K_0$	4294	4372	6901	4543	94.21	2.84	42.11	26.85	58.73	21.98
$N_{60}P_{60}K_{100}$	4513	4682	6947	4866	93.32	2.82	46.04	21.91	64.07	28.20
$N_{120}P_{30}K_{100}$	4331	4699	7050	4700	90.33	2.45	42.94	24.09	64.66	28.07
$N_{120}P_{60}K_{50}$	4155	4807	7240	4595	88.53	2.74	48.00	23.63	65.32	28.67
$N_{120}P_{60}K_{100}$	4077	4863	7455	5114	87.90	2.79	42.24	23.70	65.31	27.03
$N_{180}P_{60}K_{100}$	3755	5015	6923	5475	83.66	2.64	43.33	25.91	68.02	26.64
Expt. Mean	4267	4614	7083	4685	-	-	-	-	-	-
CD(0.05) Nutrients	Ns	107.2	Ns	152	-	-	-	-	-	-
Interaction - S in M	Ns	214.5	Ns	305	-	-	-	-	-	-
-M in S	Ns	225.7	Ns	320	-	-	-	-	-	-
CV (%)	23.89	2.84	20.5	3.98	-	-	-	-	-	-

Table.2 Nutrient requirements of recently released rice varieties and hybrids, *kharif* 2011
Nutrient requirement of test varieties (kg/ha)

Location	Variety	Maximum yield (kg/ha)	NPK level (kg/ha)	Nutrient uptake (kg/ha)			NR (kg uptake / ton grain)		
				N	P_2O_5	K_2O	N	P_2O_5	K_2O
Faizabad	US 312 (H)	5952	$N_{180}P_{60}K_{100}$	131.73	42.03	162.27	22.11	7.05	27.24
	PAC 835(H)	5484	$N_{180}P_{60}K_{100}$	121.10	38.94	122.99	22.08	7.10	22.43
	IET 21045	5010	$N_{120}P_{60}K_{100}$	136.84	40.29	152.06	27.31	8.04	30.35
	IET 19574	5010	$N_{120}P_{60}K_{50}$	124.75	39.08	140.79	24.9	7.8	28.1
DRR	US 312(H)	6220	$N_{120}P_0K_{100}$	89.46	3.73	65.51	14.38	0.60	10.53
	PAC 835(H)	7100	$N_{120}P_{60}K_0$	131.92	4.35	59.44	18.58	0.61	8.37
	IET 21045	5600	$N_{60}P_{60}K_{100}$	135.21	3.58	37.97	24.15	0.64	6.78
	IET 19574	7100	$N_0P_{60}K_{100}$	140.24	4.89	49.12	19.75	0.69	6.92

Nutrient requirement in general varied from 16 – 33 kg N, 5-9 kg P_2O_5 and 15 – 41 kg K_2O per ton of grain production and was unusually very high at Faizabad. Among the test cultures nutrient requirement for hybrids was less compared to HYVs at both the locations.

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