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Response of rice varieties to different levels of nitrogen during *Kharif* season in Northern Telangana agroclimatic zone of Telangana state India

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Abstract
Effect of nitrogen (N) levels on yield and yield components of rice cultivars was investigated in an experiment as split plot design with three replications in a paddy at Regional Agricultural Research Station, Jagtial, Karimnagar district of Telangana state in India. During *kharif* 2010 and 2011. Four rice varieties *viz*; JGL 17004 (Pradhymna), JGL 13545, JGL -11118(Anjana) and JGL-11727 (Pranahitha) were tested as pre released cultures for their response to graded levels of nitrogen *viz*; 100% RDN (100 kg recommended dose of nitrogen per ha), 125% RDN, 150% RDN and 175% RDN. Results showed that 175%RDN recorded significantly superior grain yield (5039 Kg/ha) over100% & 125% RDN, that was 11.5 %, 8.4 % and 1.5% higher over 100 % RDN, 125% RDN and 150% RDN respectively. While 150% RDN recoded comparable yield (4960 kg /ha) with 175% RDN. Among the varieties JGL 11727 & JGL13595 were found superior, recorded the grain yield of 5347 kg/ha & 5345 kg/ha, The regression pertaining to quadratic functions are highly significant. Further, the regression for the quadratic term N was positive in all the cases suggesting that grain yield increased quadratically. From initial increments of this input. But, the negative second power regression coefficient $(N)^2$ suggested that the grain yield increased at diminishing rate at higher levels of Nitrogen.

Keywords: Rice, Padhyumna (JGL-17004), Pranahitha (JGL-11727), Anjana (JGL-11118) and Nitrogen levels

Introduction
Rice is the most important cereal crop grown throughout the world and provides staple food for more than 2 billion people in Asia. More than 90% of the world's rice is grown and consumed in Asia, where in 60% of the world's population lives. It is expected that by 2025, the world will need about 760 million tons of rice in order to meet the demand for the growing population (Kamruzzaman, *et al*.., 2013) [3]. The total area of rice in world is 163.3 m ha with production of 749.7 mt (FAO 2016) [2]. India is the largest rice producing country next to the China. Rice production has increased five-fold from about 20 mt in 1950-51 to 105 mt in 2016-17. The total area of rice in India is 44.50 m ha, with a production and productivity of 108.8 mt and 2.38 t ha^{-1} respectively (Directorate of Economics and Statistics, 2015-16) [1]. Telangana State contributes to 2.09 m ha area with a production of 6.62 mt, at an average productivity of 3295 kg ha^{-1} (Season and Crop report Telangana, 2016-17). Fertilizer is the once of the most important factor deciding the yield of the rice. Among different nutrients nitrogen (N) is the most limiting nutrient for rice production and is required more consistently and in larger amounts than other nutrients (Mahajan *et al*., 2011) [4]. Nitrogen use efficiency of rice crop is as low as 25-35% and 1 kg of nitrogen is required to produce 15–20 kg of grains. The low N use efficiency has been mainly due to its rapid mineralization and proneness to losses like denitrification, leaching and volatilization through different pathways before it is utilized by the crop. Farmers are dumping higher dose of fertilizers unknowingly the meet the requirement of nitrogen of the crop. Improper dose, method and time of application of nitrogenous fertilizers results in succulent plants and enhances the plants sensitivity to water and temperature stress, susceptible to lodging and increased pest and disease incidence and causes decrease in the grain yield. Fertilizer being an expensive and precious input, determination of an appropriate dose and method of application would reduce the cost of production and enhance the productivity, and consequently increase the profits of the grower under given situations (Manzoor *et al.*, 2006) [5]. Phasing of nitrogen application at critical developmental stages is more important for efficient utilization of applied nitrogen by rice. Proper management of N is essential for achieving higher productivity, maximizing nutrient

use efficiency (NUE), and improving environmental safety by ensuring minimal losses of applied N. Presently the fertilizer recommendation for rice in Northern Telengana agroclimatic Zone of Telengana is 100-50-40 Kg per ha for *kharif* crop, for the existing and popular varieties. It is essential to recommend the appropriate dose nitrogen for the different medium duration varieties. To study the response of different nitrogen levels on yield of medium duration rice varieties and to quantify the fertilizer recommendation.

Materials and Methods

The field experiment was conducted at Regional Agricultural Research Station, Jagtial, Karimnagar district of Telangana state in India. The farm is geographically situated at 780 45'E to 79 0 0'E Longitude and 180 45' N to 190 0' N Latitude. The experimental site was a typical clayey soil, (8.22 pH) in reaction, non saline (0.47 dS m^{-1}) in nature and medium in organic carbon (0.79 g kg^{-1}). The soil under study was low in available nitrogen (107.6 kg N ha^{-1}), medium in available phosphorus (19.6 kg P_2O_5 ha^{-1}) and high in available potassium (364 kg K_2O ha^{-1}) at the initiation. Four rice varieties *viz*; JGL 17004 (Pradhymna), JGL 13545, JGL - 11118 (Anjana) and JGL-11727 (Pranahitha) were tested as pre released cultures for their response to graded levels of nitrogen *viz*; 100% RDN (100 kg recommended dose of nitrogen per ha), 125% RDN, 150% RDN and 175% RDN.

Experimental design and lay out

In the experiment, split plot design was followed with three replications. Treatment combinations were assigned at random within a block. Each plot size was 4.0 m x 2.5 m; total numbers of plots were 48 and the individual plot and the block were separated for irrigation and drainage by 0.5 m and 1.0 m channel, respectively.

Land preparation and other activities

The experimental plot was well prepared for seedling transplantation using modern technology. Fertilizers were applied in the form of urea, single super phosphate, muriate of potash, gypsum, and zinc sulphate, respectively, at the time of land preparation and different stages of plant growth. 20 days old were seedlings were transplanted in the well puddled experimental plots properly. Harvest and post-harvest operations were performed accordingly.

Data collection

To get the total tillers per hill, whole tillers were counted from each sample and then average of 10 hills was taken and presented as tillers per square meter. The rice grain and straw yield of net plots area was recorded. It was sun dried up to a constant weight. Then the grain was weighed and the grain weight $plot^{-1}$ on the sun dry basis was determined. The yield of straw in kg $plot^{-1}$ was converted into kg ha^{-1}. Length of panicle was measured from each panicle in cm from the first node to the tip of panicle and then averaged. Ten panicles were randomly selected from each harvested hill.

Statistical analysis

The collected data were statistically analyzed using ANOVA technique with the help of computer package program OPSTAT (1998) [6].

Results and discussion

During *kharif* 2010, perusal of data revealed that, significantly higher number of effective tillers (272.6 /m^2) were recorded at 175% of R+DN over over100% & 125% RDN, while 150% RDN recoded comparable effective tillers (265.1/m^2) and grain yield has increased with increase of nitrogen levels. 175% RDN recorded significantly superior grain yield (4928 Kg/ha) over 100% & 125% RDN, that was 11.6 %, 8.3 % and 1.8% higher over 100 % RDN, 125% RDN and 150% RDN respectively. While 150%RDN recoded comparable yield (4837 kg /ha) with 175%RDN. Among the varieties JGL 13595 & JGL11727 were found superior, recorded the grain yield of 5165 kg/ha & 5263kg/ha, respectively. Interaction between cultures and nitrogen levels found nonsignificant. HI also followed the same trend of yield attributes and yield of rice.

The same trend was observed during kharif 2011**,** significantly higher number of effective tillers (270 /m^2) were recorded at 175% of RDN over over100% & 125% RDN, while 150% RDN recoded comparable effective tillers (269/m^2) 175% RDN recorded significantly superior grain yield (5151Kg/ha) over 100% & 125% RDN, that was 11.3%, 8.5 % and 1.3% higher over 100 % RDN, 125% RDN and 150% RDN respectively. While 150%RDN recoded comparable yield (5083 kg /ha) with 175%RDN. Among the varieties JGL11727&JGL 13595 were found superior, recorded the grain yield of 5529 kg/ha &5428 kg/ha, respectively. Interaction between cultures and nitrogen levels found nonsignificant. HI also followed the same trend of yield attributes and yield of rice.

Table 1: Effect of different Nitrogen levels on effective tillers, grain yield and HI (%) of Rice varieties during *Kharif* 2010 & 2011

Treatment	Effective Tillers (m^2)			Grain yield (Kg ha^{-1})			HI (%)		
Varieties	**2010**	**2011**	**Pooled**	**2010**	**2011**	**Pooled**	**2010**	**2011**	**pooled**
JGL17004 (Pradhyumna)	223	238	251.75	4020	4230	4125	34.8	36.67	35.74
JGL13595	287	280	269.15	5263	5428	5345	45.25	42.7	43.98
JGL11118 (Anjana)	234	251	263.15	4282	4418	4350	36.81	37.25	37.03
JGL11727 (Pranahitha)	283	292	287.75	5165	5529	5347	43.13	43.25	43.19
Sem	5.6	3.5		93	97		0.73	1.74	
CD (V)	16.2	10.4		268.1	284		2.12	5.09	
CV (V)%	7.56	11.2		6.8	14.3		6.36	15.3	
100% RDN	241.9	241	246.95	4415	4626	4520	38.2	34.5	36.35
125% RDN	248.9	252	259.05	4549	4745	4647	37.8	38.8	38.30
150% RDN	265.1	269	267.75	4837	5083	4960	41.5	44.4	42.95
175% RDN	272.6	270	138.05	4928	5151	5039	42.3	42.11	42.21
SEM	16.2	3.5		93	97		0.73	1.74	
CD (N)	7.56	10.4		268.1	284		2.12	5.09	
CV (N)%	9.6	11.2		6.8	14.3		6.36	15.3	

Yield–input relationship

The relation between grain yield of rice and different nitrogen levels was established by least square technique. The fitted equation is as follows:

2010, y = + 3365.6 + 12.038N -0.0172N^2, R² = 0.9645*, 2011 y = 3479.4 +13.262N -0.0204N^2, R² = 0.9389* Pooled y = 7.48x + 3763, R² =0.949*

The estimated relationship indicated that the second polynomial equation (quadratic) performed well in both the years (Fig 1 and 2) as well as on pooled basis (Fig 3). The fitted equation is as follows: 2010, y = + 3365.6 + 12.038N -0.0172N^2, R² = 0.9645*, 2011 y = 3479.4 +13.262N -0.0204N^2, R² = 0.9389* Pooled y = 7.48x + 3763, R² =0.949 coefficient of determination (R^2) for the production function was 0.96, 0.93 and 0.94 during 2010, 2010 and on pooled basis, respectively. The regression pertaining to quadratic functions are highly significant. Further, the regression for the quadratic term N was positive in all the cases suggesting that grain yield increased quadratically from initial increments of this input. But, the negative second power regression coefficient (N)^2 suggested that the grain yield increased at diminishing rate at higher levels of Nitrogen.

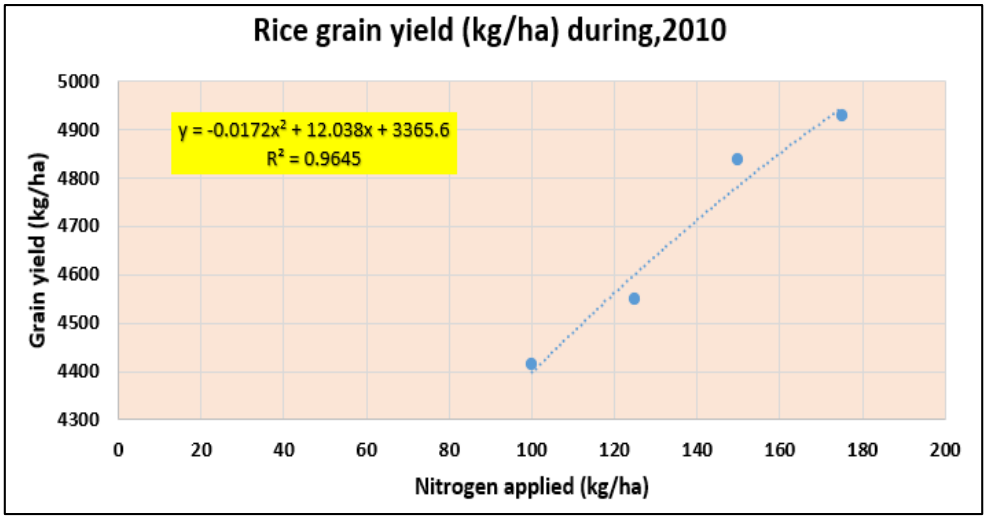

Fig 1: Polynomial response rice varieties to graded level of nitrogen during kharif, 2010

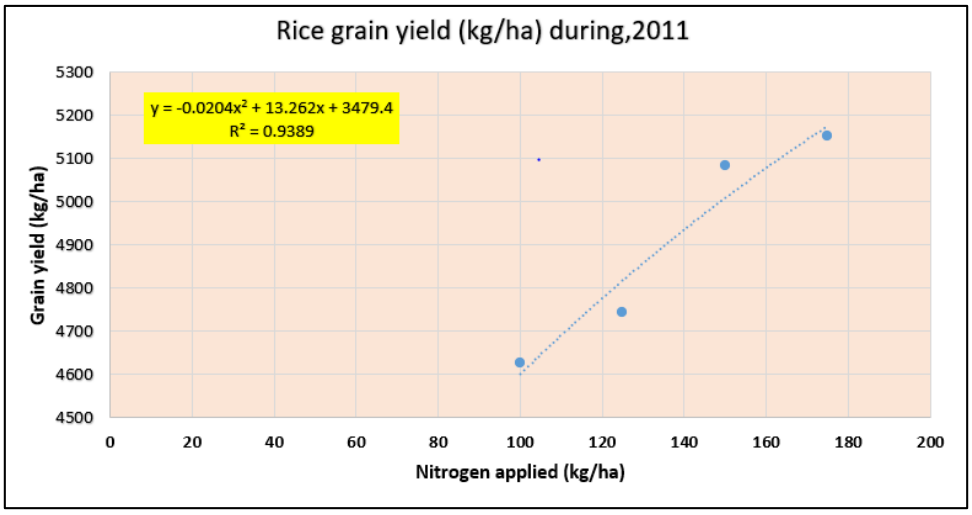

Fig 2: Polynomial response rice varieties to graded level of nitrogen during kharif, 2011

Conclusion

Application of Nitrogen at the rate of 150kg /ha to the recently released rice varieties *viz*; JGL 17004 (Pradhymna), JGL 13545, JGL -11118 (Anjana) and JGL-11727 (Pranahitha), during *kharif* season in Northern Telangana agroclimatic zone of Telangana State India is recommended.

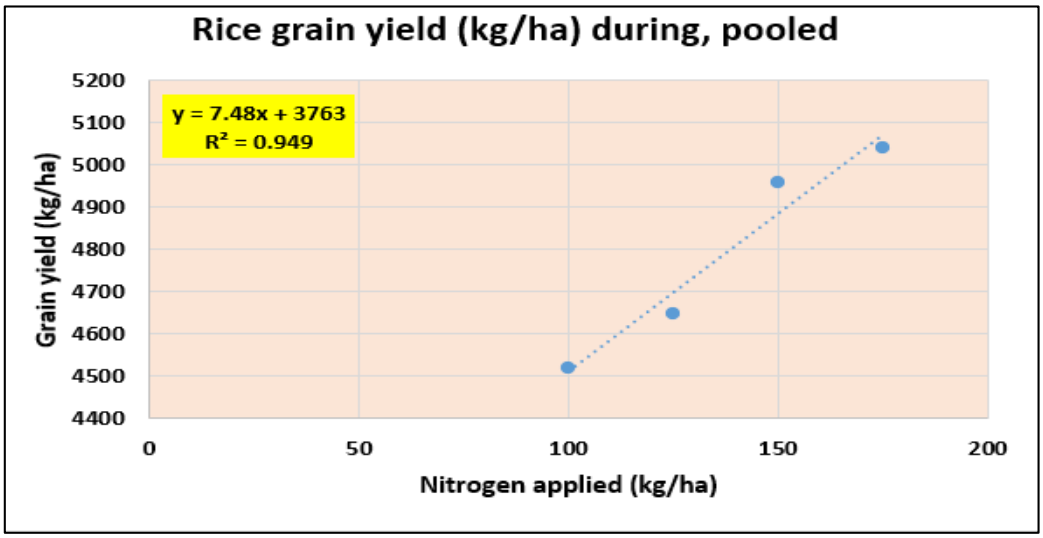

Fig 3: Polynomial response rice varieties to graded level of nitrogen pooled data

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