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Performance of Varieties under Different Nitrogen Fertilizer Levels

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Authors' contributions

This work was carried out in collaboration among all authors. Author AKC involved in graphical representation of results and myself was the authenticated person to cultivate the crop and imposed the treatments, compiled that data and taken the biometrics. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Nitrogen influence plant growth and yield of crops. To evaluate the yield potential of different pre released rice genotypes at different Nitrogen levels under Northern Telangana Zone. Experiment was laid out insplit plot design with five main plots (pre released cultures) and four sub plots (nitrogen levels) at RARS, Jagtial, *Kharif* 2018-19 to *Rabi* 2019-20.

Four pre released cultures of Northern TelaganaZone viz., C1-KNM-733, C2- KNM-1638, C3- JGL 24423 and C4: JGL-H-1 along with one check variety C5-MTU-1010 were evaluated and four nitrogen levels were tested . Based on two seasons data, 100% RDN:100-120 kg N ha^{-1} is enough with respect to KNM 1638 during *Kharif* 2018 and JGL-24423 during *Rabi* 2018-19 with 100% RDN-120-150 kg ha^{-1}. Application of 100% RDN was on par with 90% RDN with urea were recorded highest yields with respect to varieties KNM 1638 during *Kharif*and JGL-24423 during *Rabi.*The highest yield was recorded in with respect to varieties KNM 1638 (9341kgha^{-1}) followed

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JGL24423 (9927kgha^{-1}) compare to check (9,341 kgha^{-1}) during *kharif* season. Among the nitrogen levels 100% RDN recorded highest yield (10328 kg ha^{-1}) and increasing dose resulted in decreasing yield. But cost benefit ratio was also highest recorded in JGL-24423(1:1.37) followed by KNM 1638 (1:1.31) during *kharif* season. In *rabi*the highest yield was recorded in pre released cultures JGL 24423 (5802kgha^{-1}) followed by KNM 733 (5731kgha^{-1}) compare to check (4651 kgha^{-1}) and with respect to the nitrogen levels 100% RDN recorded highest yield @5231 kg ha^{-1} was on par to 90%RDN @ 4774 kg ha^{-1}. B:C ratio maximum in JGL24423 was 1.37 and KNM733 was 1.36 and among the nitrogen levels 100 RDN @ 1.32 and 90%RDN @1.02.It canbe concluded that 100% RDN-100-120 kg N ha $^{-1}$ is enough with respect varieties KNM 1638 during *Kharif* 2018-19 and JGL-24423 during *Rabi*-18-19 with 100% RDN-120-150 kg ha $^{-1}$.

Keywords: Genotypes/cultivars; nitrogen fertilizers; green manure; uptake; economics.

1. INTRODUCTION

Rice is one of the most important crops in the world and it contributes more than two thirds of the energy intake of population of South and South East Asia including India [1,2], more than 60 per cent of the global population deserves top most priority in Agriculture. About 45.5 million hectares of land in India is covered with rice producing 99.2 MT of grains, which contributes about 22.1% of world production (AIREA, 2008-09). Identification and use of high yielding potential cultivars, though ensures higher yields, the actual yield advantage depends on the agronomic management including that of nitrogen management. Yield potential of a cultivar could be exploited to a maximum extent by judicious management of applied nitrogen. In Telangana State paddy was cultivated in 6.2 million acres during kharif and 3.6 million acres during rabi [3]. Identification of location specific cultivar and optimum nitrogen dose are essential for increasing the productivity of rice. Such information is lacking for the newly developed rice cultivars *viz*; JGL 24423, JGL H-1 and KNM 733 and KNM 1638 under Northern Telangana region during *Kharif* and *Rabi* seasons. Keeping these points in view, the present investigation was under taken with the following objectives to study the to identify the yield potential of different pre released rice genotypes at different nitrogen levels under Northern Telangana Zone and to study on uptake and soil available Nitrogen and economics. Identification and use of high yielding potential cultivars, though ensures higher yields, the actual yield advantage depends on the agronomic management including that of nitrogen management. Identification of location specific cultivar and optimum nitrogen dose are essential for increasing the productivity of rice. Application of the appropriate level of nitrogen fertilizer is a major discussion with regards to economic viability of rice crop production.

2. MATERIALS AND METHODS

A field experiment was conducted in a consequent two seasons (*Kharifrabikharif* and *rabi*) at Regional Agricultural Research Station, Polasa, Jagtial, Telangana State during 2018 and 2018-2019. The treatments comprised of five varieties as main plots *viz*., C_1-KNM-733, C_2-KNM-1638,C_3-MTU 1010 (Check), C_4- JGL 24423 and C_5: JGL-H-1and Nitrogen levels as sub plots N_1-75 % RDN (90-120 kg N), N_2-100% RDN (120-150 kg N), N_3-125% RDN (155- 175 kg N), N_4-90% RDN (100-120 kg N). The treatments were laid out in split plot design with three replications.

Dhaincha as green manure was grown and incorporated in situ during *Kharif* season before rice planting. Simultaneously paddy nursery was sown during *Kharif* on 23.06.18 and during *Rabi* on 15.12.2018, respectively. The main field was plowed thoroughly and flooded 2–3 days before transplanting for puddling and levelling. Transplanted during *Kharif* on 23.07.18 and *Rabi* on 10.01.2019at a spacing of 15.0 cm x15.0 cm, with two seedlings per hill, in the field plots. The recommended dose of fertilizers for paddy during *Kharif* is 120:60:40 kg NPK ha^{-1}, during *Rabi* is 150:60:40 kg NPK ha^{-1}, were applied through urea, single super phosphate and muriate of potash, respectively in rice crop. Nitrogen was applied in three equal splits: basally, at tillering and at the panicle initiation stage. The entire phosphorus and potassium contents were applied at basal. Harvesting was done during *Kharif* on 26.10.2018 and *Rabi* 10.04.2019, respectively.

Grain and straw yields were recorded after harvest of the crop in net plot. Grain and straw samples were collected and analyzed for nutrient concentrations. Nitrogen content in plant sample was determined by micro kjeldhal distillation

method using kelpus equipment (Jackson, 1973). Phosphorous content in the di-acid extract was estimated by reacting the extract with vaadomolybdate, to form yellow colour phosphor vanadomolybdate complex in HNO3 medium. The colour was developed in about 30 minutes and the absorbance of the solution was read on spectrophotometer at 420 nm or using blue filter (Jackson, 1973).The content of potassium in diacid extract was determined by using flame photometer (Jackson, 1967) and was expressed as percentage.

The data were analysed using split plot design. Statistical analysis was performed by DOS based excel sheets used for analysis of variance (ANOVA) to determine the statistical significance of treatments. The 5.0% probability level is regarded as statistically significant.

3. RESULTS AND DISCUSSION

The results of the *kharif* -2018 indicated that, among rice varieties KNM-1638 recorded significantly higher yield of 9951 kg ha^{-1} which was on par with JGL-24423 (9927 kg ha^{-1}), KNM-733 (9457 kg ha^{-1}). Lower yields were recorded in JGL-H-1 (9061 kg ha^{-1}). Among the N levels, significantly higher yields were recorded under 100% RDN (10328 kg ha^{-1}), followed by 125% RDN (9803 kg ha^{-1}), 90% RDN (9347 kg ha^{-1}) and 75% RDN (8661 kg ha^{-1}). Interaction between rice verities and N levels found to be non significant (Table 1).

The results of *Rabi*-2018-19 also followed the similar trend in both rice varieties and N levels as Kharif - 2018 (Table 1). The variation in grain yield among different varieties was due to the differential efficiency of these varieties in converting dry matter in to grain. Similar findings were also reported regarding varietal performance under different nitrogen levels in rice by Priydarshini and Prasad [4] and Srilaxmi et al. [5].

Among the varieties higher yield was recorded with KNM 1638 (9341kg ha^{-1}) followed by JGL24423 (9927 kg ha^{-1}). Among the nitrogen levels 100% RDN recorded highest yield (10328 kg ha^{-1}) and increasing dose resulted in decreasing yield. Benefit to cost ratio was recorded higher in JGL-24423 (1:37) followed by KNM 1638 (1:31) during *Kharif* season.

During *Rabi* higher yield was recorded in JGL 24423 (5802 kg ha^{-1}) followed by KNM 733 (5731 kg ha^{-1}). With respect to the nitrogen levels 100% RDN was recorded highest yield (5231 kg ha^{-1}) which was on par to 90% RDN (4774 kg ha^{-1}). Benefit to cost ratio was maximum in JGL24423 (1.37) followed by KNM733 (1.36) and among the nitrogen levels 100 RDN (1.32) followed by 90%RDN (1.02). Adequate nutrient availability might have resulted in enhanced amount of protoplasm and chlorophyll which play vital role in increased assimilation of photosynthesis, dry matter production, number of productive tillers which finally reflected in higher grain yields [6].

During *Rabi*, the response to higher nitrogen level was due to the favourable weather conditions (bright sunshine hours) coupled with improved nutrient availability due to minimal losses under controlled irrigation over *Kharif* season [7]. The interaction effect of varieties and nitrogen levels on grain yield was found to be non-significant during both the seasons and years.

Irrespective of cultivars, with increasing nitrogen content yields were increased upto certain levels, beynd that yield decline was observed in both *kharif* (Fig. 1) and *rabi* (Fig. 3). Response of cultivars for different levels of nitrogen during kharif 2018 and rabi 2018-19 were given in Figs. 2 and 4, respectively. It indicates that all cultivars responded positively upto certain extent then showed declined yields. MTU 1010 has shown very little response to N application.Among the varieties JGL 24423 has recorded higher N and K uptake in grain (85.75 kg ha^{-1} and 18.12kg ha^{-1}, respectively), however KNM 733 has recorded higher P uptake in grain (16.01 kg ha^{-1}) (Fig. 5). Among the N levels, 100% RDF has recorded higher N, P and K uptakes, followed by 125 % RDN, 90 %RDF and 75 % RDN (Fig. 6).

During *kharif*, among the varieties JGL 24423 has recorded higher N and K uptake in grain (129.7 kg ha^{-1} and 27.71kg ha^{-1}, respectively), however MTU 1010 has recorded higher P uptake in grain (25.67 kg ha^{-1}) (Fig. 7). Among the N levels, 100% RDF has recorded higher N, P and K uptakes, followed by 125 % RDN, 90 % RDF and 75 % RDN (Fig. 8).

Increased nitrogen application led to over growth of above ground biomass and consequently, increase of leaves and stems dry weight, caused decline in N concentration and uptake [8,9].

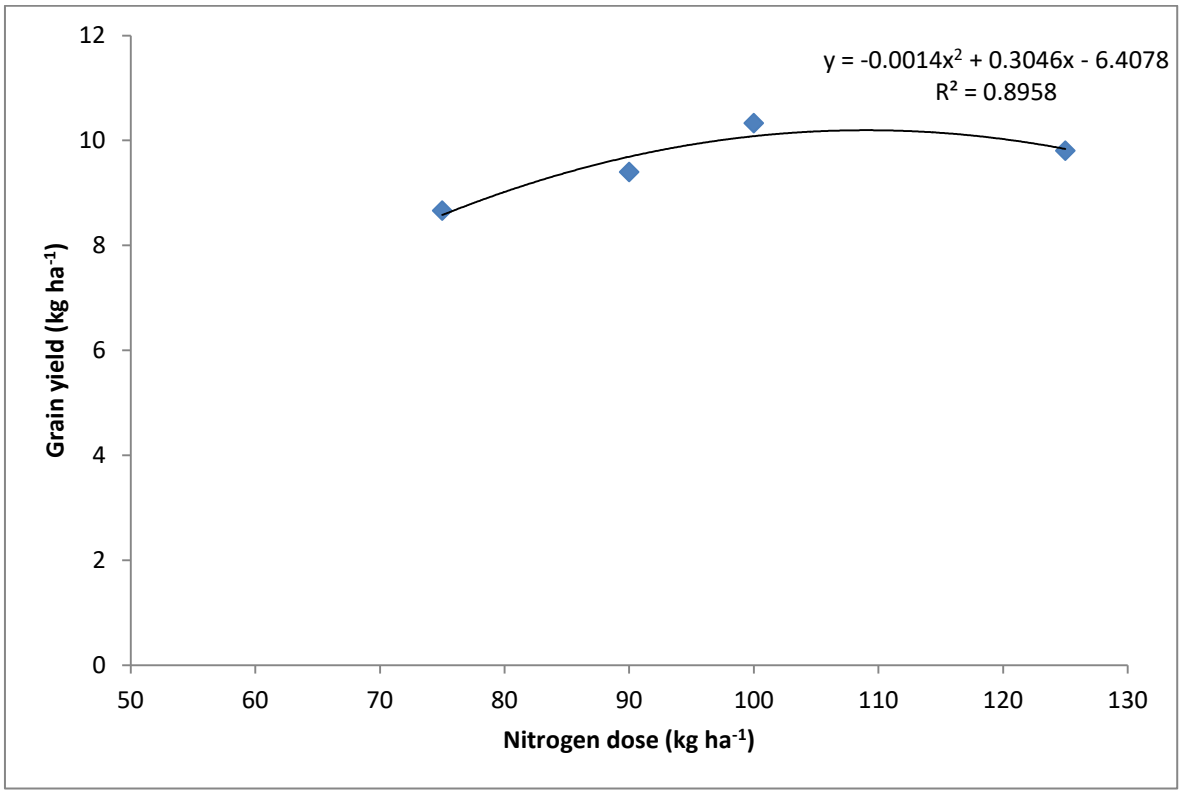

Fig. 1. Influence of nitrogen doses on grain yield of rice during *Kharif*, 2018

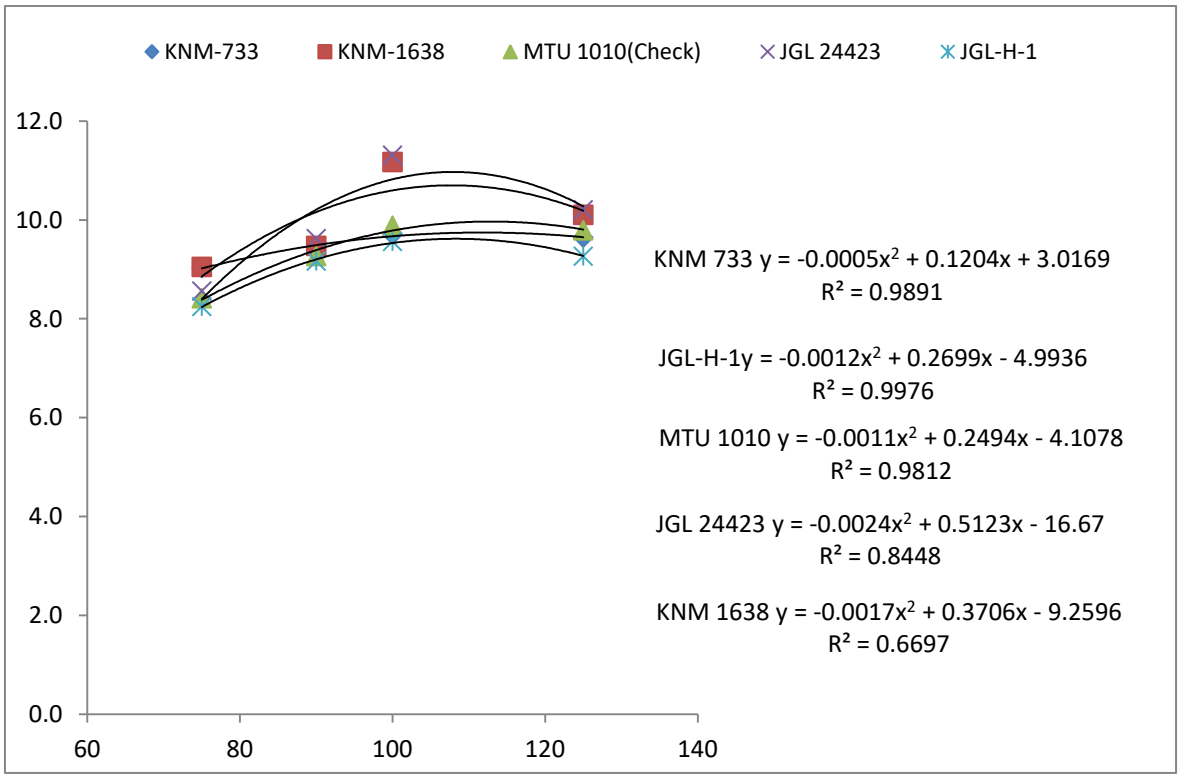

Fig. 2. Interaction of nitrogen doses on grain yield of rice during *Kharif*, 2018

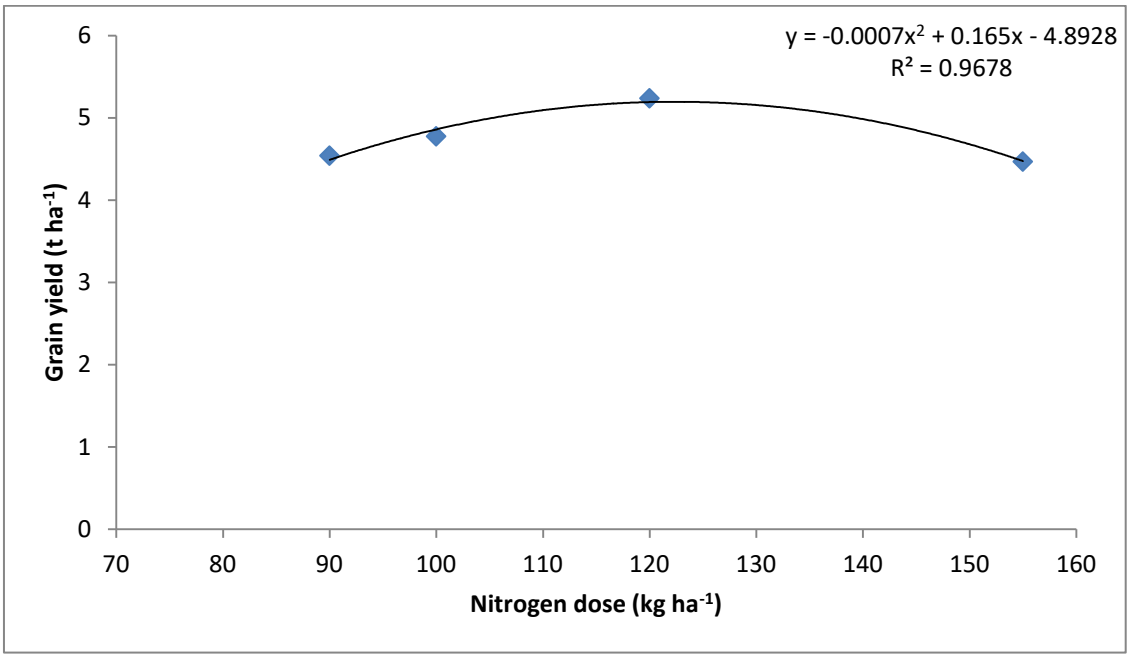

Fig. 3. Influence of nitrogen doses on grain yield of rice during *Rabi*, 2019-20

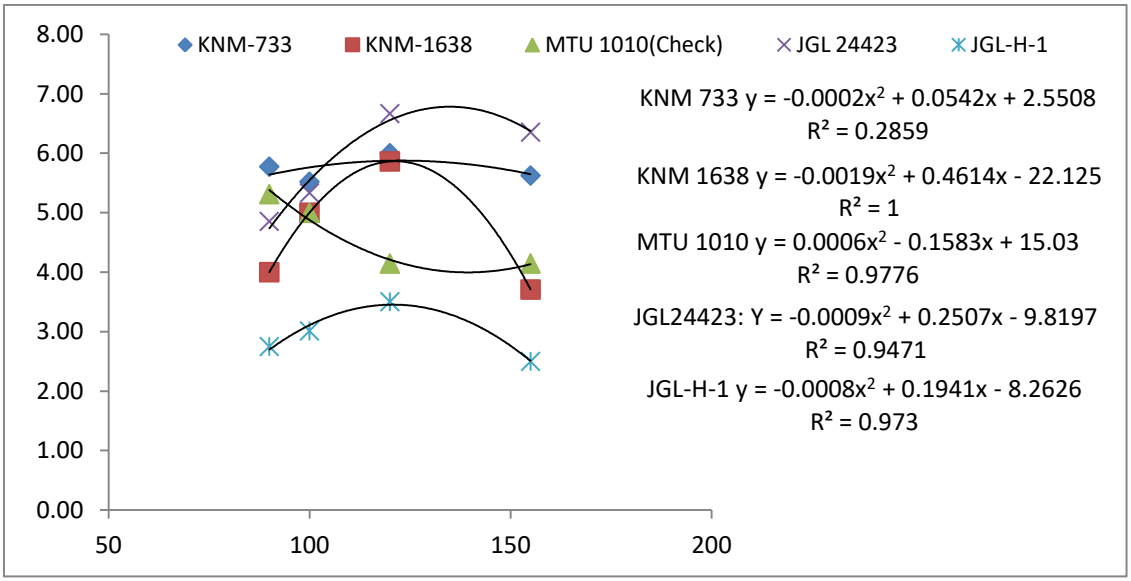

Fig. 4. Interaction of nitrogen doses on grain yield of rice during *Rabi*, 2019-20

Table 1. Effect of different treatments on yield during *Kharif*– 2018 and *Rabi*-2018-19

	***Kharif*– 2018**		***Rabi*-2018-19**	
Treatments	**Grain yield kg ha^{-1}**	**Straw yield kg ha^{-1}**	**Grain yield kg ha^{-1}**	**Straw yield kg ha^{-1}**
Cultures				
C1-KNM-733	9457	9109	5,731	6,440
C2- KNM-1638	9951	8594	4,643	6,204
C3- MTU 1010(Check)	9341	8932	4,651	6,022
C4- JGL 24423	9927	9406	5,802	6,084
C5: JGL-H-1	9061	9766	2,942	6,111

	Kharif– 2018		*Rabi*-2018-19	
Treatments	**Grain yield kg ha^{-1}**	**Straw yield kg ha^{-1}**	**Grain yield kg ha^{-1}**	**Straw yield kg ha^{-1}**
Sem±	199	276	281	77
CD 5%	571	792	931	254
N levels				
N1-75 % RDN	8661	9553	4,539	6,017
N2	10328	8505	5,236	6,408
N3	9803	9296	4,467	6,171
N4	9397	9293	4,774	6,091
Sem±	178	247	202	86
CD 5%	511	708	587	250
Interaction CD 5%	NS	NS	NS	NS

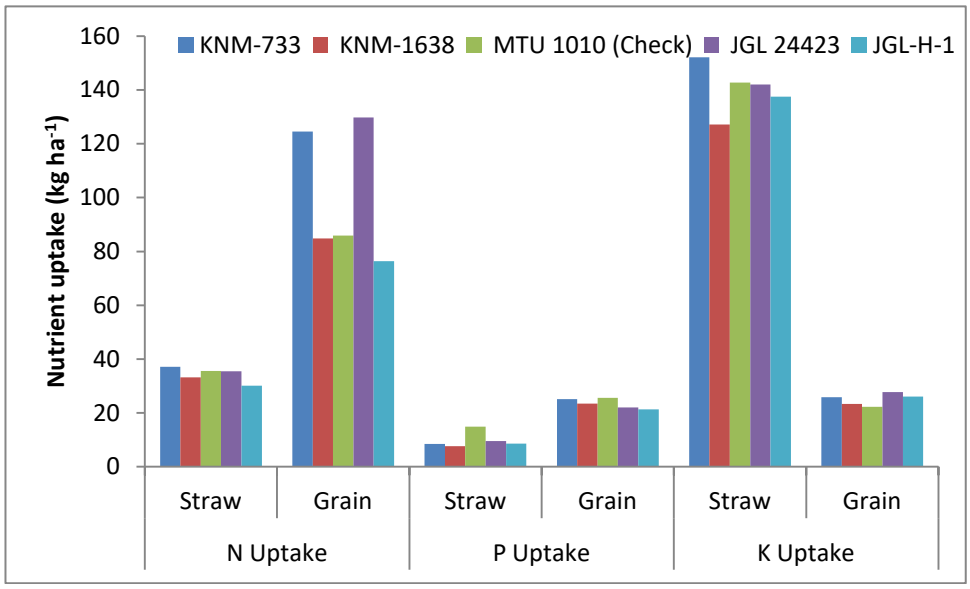

Fig. 5. Nutrient uptake as influenced by rice varieties during *Kharif*, 2018

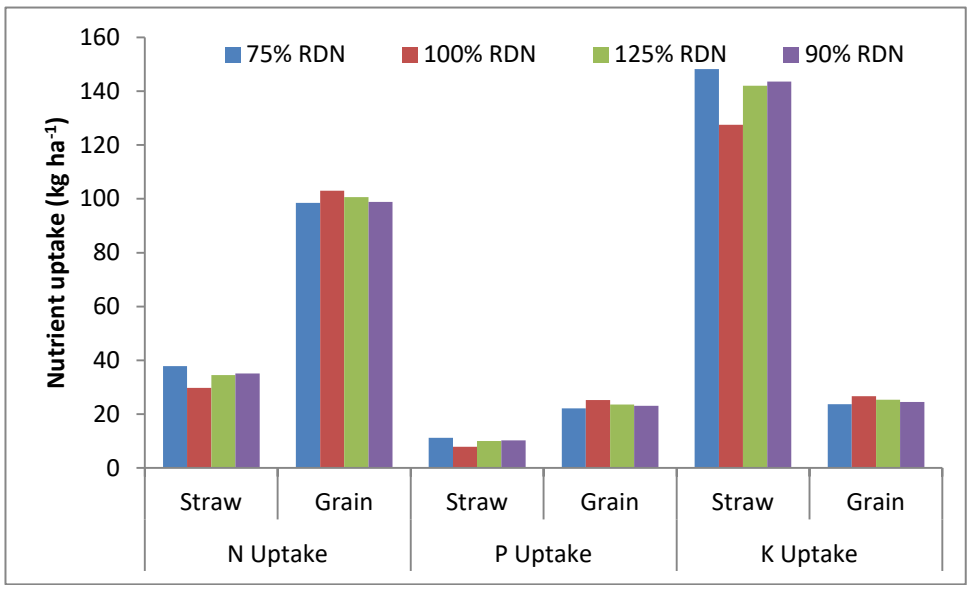

Fig. 6. Nutrient uptake as influenced by N levels during *Kharif*, 2018

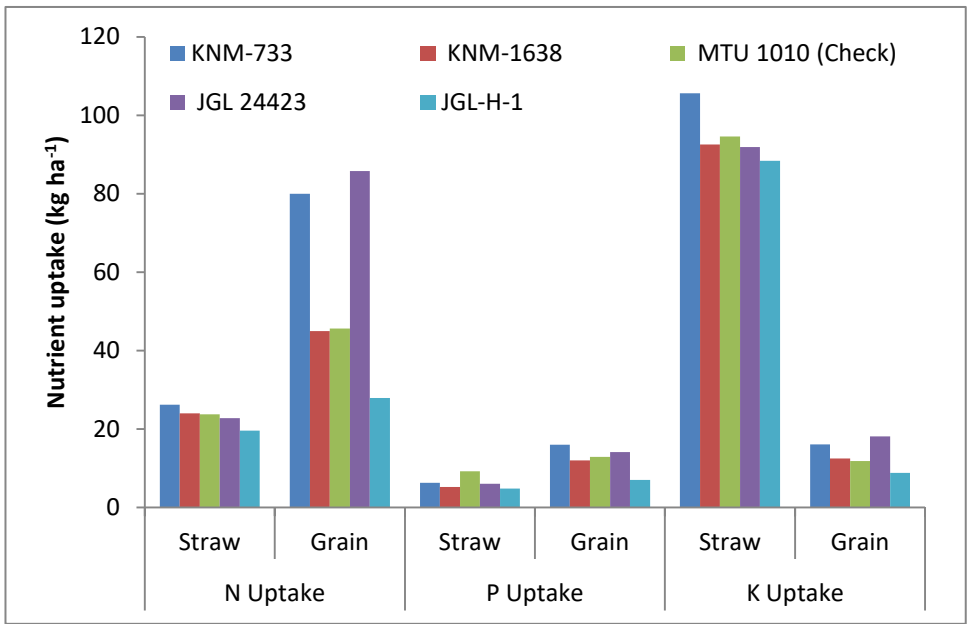

Fig. 7. Nutrient uptake as influenced by rice varieties during *Rabi*, 2018-19

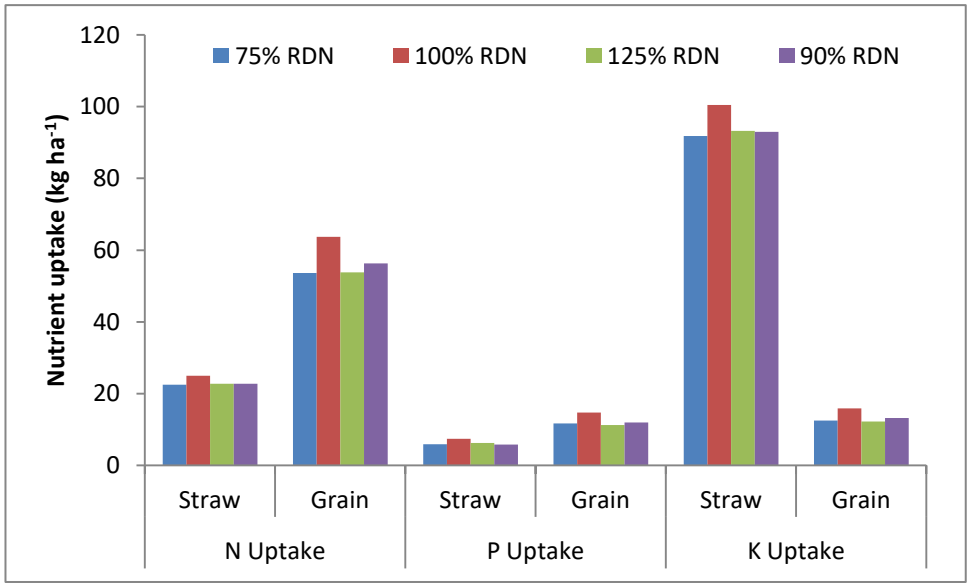

Fig. 8. Nutrient uptake as influenced by N levels during *Rabi*, 2018-19

4. CONCLUSION

The major findings of the study, revealed that based on two seasons data, 100% RDN: (100-120 kg N ha^{-1}) is enough with respect to varieties KNM 1638 during *Kharif* 2018 and JGL-24423 during *Rabi* 2018-19 with 100% RDN (120-150 kg ha^{-1}). Application of 100% RDN was on par with 90% RDN with neem coated urea were recorded highest yields with respect to the varieties KNM 1638 during *Kharif* and JGL-24423 during *Rabi*. Nitrogen and potassium uptake were recorded higher under JGL-24423 in both the seasons and P uptake was higher under KNM 733 during *Rabi* and MTU 1010 during*Kharif* .

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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