Study on response of rice varieties to different nitrogen fertilizer levels

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Introduction

Rice (Oryza sativa L.) is the single most important crop and the staple food of more than three billion people or more than half of the world's population. Paddy is cultivated as a wetland crop in all districts. Direct or indirect involvement for paddy sector is more than 30 % of the total labour force (Wickramasinhe and Wijewardena, 2000). Rice provides 45% total calorie and 40% total protein requirement of an average Sri Lankan (Department of Agriculture,2010).The areaunder paddy production in yalaand maha was 1,671,054 Mt and 2,629,566 Mt respectively (Department of Census and Statistics, 2010). Nitrogen, phosphorous and potassium are the three major nutrients required for the rice plant. Nitrogen (N) is one of the essential macro -nutrients for rice growth and one of the main factors to be considered for developing a high-yielding rice cultivar. Nitrogen increases plant height, panicle number, leaf size, spikelet number, and number of filled spikelets, which largely determine the yield capacity of a rice plant. Panicle number is largely influenced by the number of tillers that develop during the vegetative stage. Rice plants require nitrogen during the tillering stage to ensure a sufficient number of panicles and reproductive to grain filling. Nitrogen imbalance in soil produces low fertilizer use efficiency, low yields and low farmer profit.Main nitrogen loss mechanisms are volatilization of ammonia (NH_3), leaching loss of nitrate (NO_3^-), loss through denitrification and soil erosion (Choudhury and Kennedy, 2005).Therefore, optimum level of nitrogen fertilizer should be applied to get maximum yield of paddy cultivation and utilize nitrogen fertilizers effectively (Fageria and Baligar, 2003).

Materials and Methods

This study was conducted at the Rice Research Development Institute (RRDI) at Batalagoda in Kurunagala district, Sri Lanka. Fertilizers used were urea as the Nitrogen source, and others; Triple super phosphate and Murate of Potash. The experiment was comprised with sixteen treatments. Nitrogen fertilizer was applied as 0, 50, 100 and150 kg N ha-1. Four rice varieties, Bg 1350 (V1), Bg 997 (V2), Bg 379-2 (V3) and Bg 450 (V4) were tested. These four rice varieties are in age group of four to four and half months.Sixty four plots were arranged according to the split plot design with sixteen treatments and four replicates.

Plant height, number of tillers per hill, plant greenness, number of days for 100 % flowering of rice varieties, dry weight of shoot parts, plant nitrogen content, number of panicles per hill and grain yield were measured against different nitrogen levels.

Result and Discussion

As the results showed (Table 1) there was a significant effect ($P<0.005$) among the treatments for the plant height, number of tillers per hill, plant greenness, number of days for 100 % flowering of rice varieties, plant nitrogen content, number of panicles per hill and grain yield.

There is no statistically significant difference among the levels of nitrogen and variety with dry weight of shoot parts.

Table 1:Means of plant parameters for different treatments

Treatments	Plant height	Number of tillers	Plant SPAD reading	Dry weight of shoot parts	Grain weight	Number of dates of 100 % flowering	Nitrogen content of shoot parts	Number of panicles per hill
N0V1	64.86^{a}	7.26^{a}	27.49^{a}	11.43^{a}	2.35^{a}	79.30^{b}	2.12^{a}	7.73^{a}
N1V1	75.46^{ab}	9.66^{a}	33.21^{ab}	21.16^{a}	3.58^{ab}	79.33^{a}	2.70^{a}	9.66^{a}
N2V1	78.33^{a}	12.13^{a}	36.90^{b}	24.12^{a}	3.71^{c}	78.70^{bc}	3.17^{a}	9.53^{a}
N3V1	83.13^{a}	12.40^{a}	38.32^{b}	26.55^{a}	4.21^{b}	80.70^{a}	3.26^{b}	11.46^{a}
N0V2	64.80^{a}	6.60^{a}	28.25^{a}	12.66^{a}	2.75^{a}	72.00^{c}	2.56^{a}	7.26^{ab}
N1V2	77.73^{a}	8.33^{a}	34.73^{a}	19.12^{a}	3.91^{a}	71.00^{b}	3.15^{a}	8.66^{a}
N2V2	78.00^{a}	9.80^{ab}	37.55^{b}	25.74^{a}	4.91^{a}	75.70^{c}	3.50^{a}	9.00^{a}
N3V2	80.33^{ab}	10.93^{b}	38.09^{b}	28.79^{a}	5.31^{a}	75.33^{b}	3.78^{a}	9.86^{a}
N0V3	51.40^{b}	7.26^{a}	28.15^{a}	14.69^{a}	2.45^{a}	85.00^{a}	2.54^{a}	7.13^{ab}
N1V3	61.93^{c}	9.66^{a}	30.54^{a}	22.2^{a}	3.65^{ab}	81.33^{a}	3.29^{a}	9.00^{a}
N2V3	61.13^{b}	10.86^{ab}	34.10^{c}	22.01^{a}	3.65^{c}	85.00^{a}	3.52^{a}	9.13^{a}
N3V3	69.06^{c}	12.60^{a}	38.16^{b}	28.53^{a}	5.00^{a}	81.70^{a}	3.59^{ab}	11.06^{a}
N0V4	62.73^{a}	6.26^{a}	30.37^{a}	12.39^{a}	2.56^{a}	80.00^{b}	2.52^{a}	5.60^{a}
N1V4	68.73^{bc}	9.26^{a}	32.98^{ab}	19.75^{a}	3.16^{b}	80.33^{a}	3.19^{a}	8.93^{a}
N2V4	76.46^{a}	9.20^{a}	40.26^{a}	22.30^{a}	4.20^{b}	81.00^{b}	3.29^{a}	8.93^{a}
N3V4	76.73^{b}	11.53^{ab}	43.72^{a}	24.95^{a}	4.76^{ab}	83.33^{a}	3.75^{a}	9.93^{a}

Means followed by the same letter in the same column are not significantly different at $P< 0.05$.

Conclusions

The results showed that the responses to application of nitrogen fertilizer vary among the rice varieties.

Plant height , number of tiller per hill, plant greenness, dry weight of shoot parts, plant nitrogen content of shoot parts, grain yield and number of panicles per plant of four rice varieties increase with increasing level of nitrogen fertilizer and respond positively.

References

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