SHORT COMMUNICATION

EFFECT OF NITROGEN AND SULPHUR LEVELS ON GROWTH, YIELD AND NUTRIENT UPTAKE OF HYBRID RICE IN INCEPTISOL

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Abstract: A field experiment was conducted at the Instructional Farm of the Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) during *kharif* season, 2010 and 2011 to evaluate the nitrogen and sulphur requirement of hybrid rice in Inceptisol. The Sixteen treatments comprising 4 levels each of N (0, 80, 160 & 240) and S (0, 20, 40 & 60 kg ha^{-1}) were laid out in randomized block design with three replications. Hybrid rice variety PHB-71 was taken as test crop. The experimental soil was silt loam in texture having bulk density 1.38 M gm^{-3}, water holding capacity 23.11 %, pH (1:2.5) 8.80, EC 0.41 dSm^{-1}, Organic carbon 2.7 g kg^{-1}, exchangeable sodium percentage 29.9, available N 203, P_2O_5 15.25, K_2O 265 and S 13.38 kg ha^{-1}.The required quantity of fertilizer was applied through urea and sulphur with elemental sulphur before transplanting. The growth, yield and yield attributes increased with increasing nitrogen and sulphur doses up to 240 $kgha^{-1}$ and 60 kg ha^{-1}, respectively. Maximum yield, yield attributes were recorded with the application 240 kg ha^{-1}, which was significantly superior over 80 kg N ha^{-1} and at pat with 160 kg N ha^{-1}. Likewise maximum yield and yield attributing parameter and nutrient uptake were recorded with 60 kg S ha^{-1} which was significantly superior over 20 kg S ha^{-1} and statistically at par 40 kg S ha^{-1}. The maximum net return (Rs. 54559.72) and cost benefit ratio (1.874) were obtained by applying 160 kg N ha^{-1} with 40 kg S ha^{-1} by PHB-71 in Inceptisol of Uttar Pradesh.

Keywords: Hybrid Rice, Nitrogen, Sulphur

INTRODUCTION

Rice is an important leading cereal crops grown all over the world. It is staple food of more than 70 per cent of the world population. India needs to produce more rice to feed the ever grown population for which the hybrid cultivation is only available strategy. The suitable dose of fertilizer is of prime importance that promotes the efficient utilization of nutrients. The present strategy of increasing food production essentially involves the balanced use of fertilizers to hybrid rice because all the varieties give their full yield potential with adequate supply of nutrients. Among major essential nutrients, nitrogen and sulphur play very pivotal role for growth and metabolic process in rice plant. Among major nutrients nitrogen is most important particularly in our country. Most of the Indian soils are deficient in this nutrient. The deficiency of nitrogen and sulphur are also coming up as a serious problem in rice, mostly in light textured and salt affected soils. The relationship between nitrogen and sulphur has been studied by several workers in different crops but the interaction between nitrogen and sulphur in hybrid rice, especially in sodic soil is of great importance and very little investigation has been made so far in this regard. Thus, present investigation was carried out to study the nitrogen and sulphur requirement of hybrid rice for salt affected soil of eastern Uttar Pradesh.

MATERIAL AND METHOD

The filed experiment was conducted during *Kharif* season, 2010 and 2011at Instructional Farm of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.). Sixteen treatments comprising 4 levels each of N (0, 80, 160, and 240) and S (0, 20, 40, and 60 $kgha^{-1}$) were evaluated in randomized block design replicated thrice. The variety of hybrid rice PHB-71 was taken as test crop. The experimental soil was silt loam in texture having bulk density 1.38 Mgm^{-3}, water holding capacity 23.11 %, pH (1:2.5) 8.80, EC 0.41 dSm^{-1}, organic carbon 2.7 g kg^{-1}, exchangeable sodium percentage 29.9, available N 203, P_2O_5 15.25, K_2O 265 and S 13.38 kg ha^{-1}.The required quantity of fertilizer was applied through urea and sulphur with elemental sulphur before transplanting. Common doses of fertilizers were applied through diammonium phosphate and muriate of potash. One third dose of nitrogen and total phosphorus and potash were applied as basal before puddling and incorporated in the top 15 cm soil, remaining dose was applied as top dressing in two equal splits each at tillering and panicle initiation stage, respectively. The various physico-chemical properties of soil were determined as per standard procedures.

RESULT AND DISCUSSION

Growth, yield and yield attributes

The results presented in table-1 indicated that the plant height, number of tillers m^{-2} , number panicles m^{-2} , number of seeds $panicle^{-1}$, test weight and grain & straw yield increased with increasing levels of nitrogen up to 240 kg N ha^{-1}. The maximum response was recorded at nitrogen 240 kg N ha^{-1} which was at par with 160 kg N ha^{-1}. This might be due to better utilization of nutrients. These results are in close conformity with the findings of Meena *et. al.* (2003), Malik and Kaleem (2007), Zaidi and Tripathi (2007). Application of sulphur also increased yield and yield attributes with increasing levels of sulphur.

The increase in yield and yield attributes by the application of S might be due to maximum response of sulphur was recorded with the application of 60 kg S ha^{-1} which was significantly superior over 20 kg ha^{-1} and at par with 40 kg S ha^{-1}.

Protein Content

The maximum protein content (table-1) in grain (8.00%) was recorded with the application of nitrogen 240 kg N ha^{-1} which was found significantly superior over 80 kg Nha^{-1} (6.44%) and at par with 160 kg ha^{-1} (7.63%). The increase in protein content due to application of N might be due to the fact that N is constituent of protein. These results also corroborated with the findings of Dwivedi *et. al.* (2006). Application of sulphur also increased the protein content with increasing levels. Maximum response of sulphur was recorded with 60 S kg ha^{-1}which was significantly superior over 20 kg S ha^{-1} and at par with 40 kg S ha^{-1}. This might be due to increased sulphur assimilation in plants because nitrogen and sulphur are major component of amino acids and protein. Similar findings were also reported by Chandel *et. al.* (2003).

Nutrient Uptake

The uptake of nutrients (table-2) increased with increasing levels of nitrogen up to 240 kg N ha^{-1} which was found significantly superior over 80 kg Nha^{-1} and at par with 160 kg ha^{-1}. The maximum uptake of the nutrients viz. N, P, K and S were recorded with the application of 240 kg Nha^{-1}. It was mainly due to increase in concentration of nutrients in grain and straw along with increase in yields. Similar findings were also reported by Om *et.al.* (1998). the uptake of nutrients also increased with the application of sulphur. The highest nutrients (N, P, K and S) uptake were recorded at 60 kgSha^{-1} which was significantly superior over 20 kgSha^{-1} and at par with 40kg S ha^{-1}.This might be due to increased assimilation of sulphur because sulphur is a constituent of amino acids that work as building block of the plant. These results also corroborated the findings of by Singh *et.al.* (1993).

Table 1. Effect of nitrogen and sulphur on growth and yield attributes of hybrid rice at harvest stage.

Treatments	Plant height(cm)	No. of tillers m^{-2}	No. of panicles m^{-2}	No. of grains $panicle^{-1}$	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Test weight (g)	Harvest index (%)
Nitrogen levels (kg ha^{-1})								
N_0	100.06	284.33	257.15	112.46	46.45	58.11	21.24	44.38
N_{80}	112.67	345.83	284.95	131.92	58.25	72.20	22.74	44.58
N_{160}	123.18	370.17	336.59	149.13	68.51	83.03	23.17	45.17
N_{240}	128.40	375.83	337.79	151.56	68.95	85.40	23.70	44.65
SEm ±	2.38	4.99	6.09	2.81	1.25	1.53	0.20	0.60
C.D. at 5%	6.89	14.43	17.58	8.12	3.61	4.41	0.58	NS
Sulphur levels (kg ha^{-1})								
S_0	103.06	307.08	263.32	115.55	52.19	66.37	21.66	43.96
S_{20}	111.69	343.08	282.61	130.11	57.72	71.50	22.45	44.58
S_{40}	122.36	361.42	334.16	148.21	65.81	79.51	23.24	45.30
S_{60}	127.21	364.58	336.38	149.21	66.45	81.44	23.49	44.94
SEm ±	2.38	4.99	6.09	2.81	1.25	1.53	0.20	0.60
C.D. at 5%	6.89	14.43	17.58	8.12	3.61	4.41	0.58	NS

Table 2. Effect of nitrogen and sulphur on uptake of hybrid rice at harvest stage.

Treatments	Nutrient Uptake (kg ha^{-1})							
	Nitrogen		Phosphorus		Potassium		Sulphur	
Nitrogen levels (kg ha^{-1})	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
N_0	44.38	39.51	13.10	7.22	26.94	52.90	17.90	12.36
N_{80}	60.22	54.27	17.90	10.43	37.97	72.17	25.06	17.52
N_{160}	84.01	66.42	23.47	13.48	47.95	106.71	33.56	21.95
N_{240}	88.43	69.24	24.55	14.86	48.95	107.35	34.47	23.40
SEm ±	2.21	2.47	0.47	0.50	0.81	1.95	0.89	0.88
C.D. at 5%	6.40	7.13	1.38	1.45	2.34	5.36	2.58	2.55
Sulphur levels(kg ha^{-1})								

S_0	44.88	45.79	15.36	8.18	29.22	64.37	19.59	13.46
S_{20}	64.50	53.13	18.38	10.87	36.36	80.08	25.17	16.68
S_{40}	78.97	62.81	21.96	12.77	46.72	93.02	32.69	21.68
S_{60}	80.40	65.15	23.33	14.18	47.84	96.09	34.38	23.23
SEm ±	2.21	2.47	0.47	0.50	0.81	1.95	0.89	0.88
C.D. at 5%	6.40	7.13	1.38	1.45	2.34	5.36	2.58	2.55

Table 3. Economic parameters of hybrid rice.

Treatment combinations	Grain yield ($qha^{-1)}$	Straw yield (qha^{-1})	Cost of cultivation ($Rs.ha^{-1}$)	Gross return ($Rs.ha^{-1}$)	Net return ($Rs.ha^{-1}$)	Benefit cost ratio
N_0S_0	39.82	51.24	23892.135	44944	21051.865	0.881
$N_0 S_{20}$	44.25	56.32	25539.185	49882	24342.815	0.953
N_0S_{40}	50.62	61.28	27186.185	56748	29561.815	1.087
N_0S_{60}	51.10	63.58	28833.285	57458	28624.715	0.992
$N_{80}S_0$	49.64	64.33	24848.655	56073	31224.345	1.256
$N_{80} S_{20}$	55.33	68.62	26495.705	62192	33696.295	1.347
$N_{80}S_{40}$	63.39	77.23	28142.755	71113	42970.247	1.526
$N_{80}S_{60}$	64.64	78.62	29789.805	72502	42712.195	1.433
$N_{160}S_0$	58.85	73.25	25805.175	61175	40369.825	1.564
$N_{160}S_{20}$	65.32	78.27	27452.225	73147	49694.775	1.664
$N_{160}S_{40}$	74.63	90.29	29099.275	83659	54559.725	1.874
$N_{160}S_{60}$	75.25	90.32	30747.325	84282	53534.675	1.741
$N_{240}S_0$	60.43	76.66	26761.645	68096	41334.335	1.544
$N_{240}S_{20}$	65.98	82.81	27718.165	74261	46542.835	1.679
$N_{240}S_{40}$	74.60	89.23	30055.745	83523	53467.255	1.789
$N_{240}S_{60}$	74.80	93.25	31702.795	84125	52422.205	1.653

CONCLUSION

On the basis of experimental results, it may be concluded that the application of 240 $kgNha^{-1}$ as well as 60 kg Sha^{-1} produced highest grain and straw yield, protein content and uptake of nutrients (N, P, K, and S). However these levels of nutrients were statistically at par with the application of 160KgN and 60 kg S ha^{-1}.

Thus, the recommendation of 160 N and 40kg S ha^{-1} may be given for better performance of hybrid rice.

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