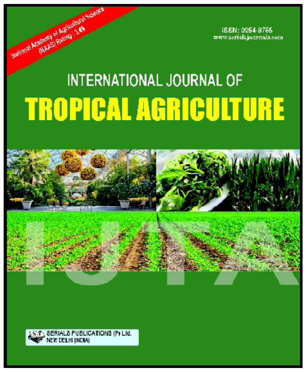

INTERNATIONAL JOURNAL OF TROPICAL AGRICULTURE

ISSN : 0254-8755

available at http: www.serialsjournals.com

Volume 36 • Number 1 • 2018

Nitrogen Requirement of Basmati Rice in Conjunction with Application of Potassium

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Abstract: Rice-wheat is the most important crooping system of the Indo Gangetic plains and basmati rice occupies twenty per cent of the rice area. Most of the basmati rice varities are prone to lodging and potassium is an element which can help prevent lodging. Therefore, an experiment was conducted on a sandy loam soil to investigate the interactive effects of nitrogen and potassium on the producutivity of basmati rice (Pusa basmati 1509). The results indicated that the grain yield of Pusa basmati 1509 increased significantly only upto 60 Kg N/Ha and beyond this the increase was not significant. Application of K however did not cause any significant change in the yield of basmati rice, though there was a numeric increase in the seed yield of BR with the application of potassium. No significant interactive effect of applied N and V was observed on the yield of Pusa Basmati 1509. The yield of succeeding wheat remained statistically at par with different levels of applied N & K. No interaction effect of N & K was also observed on yield of wheat.

Key words: Basmati rice, Wheat, Nitrogen, Potassium, Yield, Soil, Available

INTRODUCTION

Rice-wheat is the dominant cropping system of the Indo Gangetic plains occupying an area of more than 26 million ha. It accounts for one third area of both rice and wheat grown in south asia and rice-wheat provides food for over 20% of the world's population. Both rice and wheat are exhaustive feeders and the extensive adoption of this cropping system is depleting the soil of its nutrient contents. This system removes much more nutrients than are applied in the form of fertilizers. One cropping cycle may remove around 300-350 kg N /ha, 35-45 kg P/ha and around 350 kg of potassium causing a negative balance of N and K particularly where the residues are burnt. In alluvial soils of Punjab which are rich in illite mineral considered to supply sufficient K to plants and K is not a part of fertilizer package. But long term cultivation of rice-wheat has resulted in no long increased production with increase in inputs and evidence of declining total or partial productivity are already becoming available (Hobbs and Morris, 1996).

Basmati rice is an important staple food in the human diet of south Asia. The aroma of basmati rice makes it unique for quality and as such is a gift of nature to Indian sub-continent. The climate of foothills of the IGP is very conducive for the production of these aromatic varieties. Basmati rice is being grown by Indian farmers since centuries (Nene 1998). In the world trade markets, rice is traded as aromatic and non-aromatic rice. India dominates in the trade of aromatic rice and Pakistan stands at second place. Most of the basmati rice varieties are aromatic, long and fine-grained and therefore fetch higher price in the world trade markets. As far as production and export of basmati rice are concerned, India stands at number one. In India about 12 - 16 lac tonnes of basmati rice is produced every year and only one-third of it is consumed in the country and the remaining two-third is exported. Basmati rice occupies an area of around 20% of the area under rice. So the nutritional requirement of it gains equal importance. The N requirement of basmati rice is lower than that of coarse rice as the basmati rice varieties are prone to lodging. Potassium is an element which is known to provide strength to the stem and may help preventing lodging. The research information on interactive effects of N and K requirement on basmati rice productivity is lacking. Keeping these points in view, a field experiment was initiated to find out the N requirement of Pusa basmati 1509 in conjunction with K on a sandy loam soil.

MATERIALS AND METHODS

The study was conducted in the experimental area of the Department of Soil Science, Punjab Agricultural University, Ludhiana, Punjab during 2015-16. The soil of the experiment field was sandy loam in texture and the physico-chemical characteristics of the soil used for the experiments are given in Table 1. Five levels of N viz. 0, 30, 60, 90 and 120 kg N/ha were tested along with three levels of K @ 0, 30, and 60 kg/ha in split plot design. Levels of nitrogen were kept in main plots and K levels were kept in sub plots and there were three replications of each treatment.. Nitrogen was applied through urea and K was applied through muraite of potash. Nitrogen was applied in two splits half at transplanting and half at 30 days after transplanting whereas whole of the K was applied at the time of sowing. Basmati rice was transplanted on 10^{th} july and harvested in the month of November, thereafter wheat was sown in the same plots and was grown with recommended package of practices. Basmati Pusa 1509 was grown under puddle transplanted conditions and wheat was grown under upland conditions. For determination of changes in available potassium, soil samples of different treatments were collected for their analysis. Soil samples were collected from 0 to 15 cm layer, dried in shade and ground to pass through 2 mm sieve. Soil samples were then analysed for available K (Merwin and Peech, 1950). At the time of harvest, grain samples of basmati rice were collected from different treatments and oven-dried at a temperature of 70oC. The dried samples were ground in a stainless steel Willey mill. For the determination of K in basmati rice grain a known weight of grain samples were digested at 150°C in diacid mixture of HClO4 and HNO3 in the ratio of 3:1. The soil available K and the plant grain K were determined on flame photo meter using appropriate standard. Soil texture was determined by the method of Day (1965). Soil pH was measured by Elico pH meter. Conductivity cell attached to Elico EC Bridge was used to determine EC. Organic carbon was determined by the method of (Walkley and Black (1934). Available Nitrogen (N) was measured by the method of Subbiah and

Asija (1956) Available phosphorus and K were determined by the methods of Olsen *et al (*1954) and Merwin and Peech (1950).

Table 1
Physico-chemical characteristics of the soil used for screen house experiment

Characteristics	*Contents*
pH (1:2, soil : water suspension)	7.6
EC (dS m^{-1}) (1:2, soil : water suspension)	0.25
Organic Carbon (%)	0.36
$CaCO_3$ (%)	0.39
Available N (kg ha^{-1})	185.2
Available P (kg ha^{-1})	14.2
Available K (kg ha^{-1})	145.2
Mechanical Composition	
Sand (%)	56.2
Silt (%)	27.1
Clay (%)	16.5
Texture	Sandy loam

RESULTS AND DISCUSSION

The data on yield of Pusa Basmati 1509 are presented in table 1 Significant variation in yield was observed with the application of nitrogen. The mean grain yield of Pusa 1509 increased 25.7q/ha in control to 28.6, 37.9,3 8.3 and 38.9 q/ha in 30, 60, 90 and 120 Kg N/ha treatments. However the increase was significant only upto 60 Kg N/Ha and beyond this the increase was not significant. Application of K however did not cause any significant change in the yield of basmati rice, though there was a numeric increase in the seed yield of BR with the application of potassium. No significant interactive effect of applied N and V was observed on the yield of Pusa Basmati 1509. This could be because of the release of sufficient and out of potassium from soil during Kharif season due is higher prevailing temperature and moisture and additional suspicious of K through fertilizer might not have therefore been helpful in increasing the BR yield further. The results of the present study are in conformity with the findings of Tondon and Sekhon (1988).

Table 2
Yield of basmati rice (Punjab Pusa basmati 1509) as influenced by N and K levels (kg/ha)

N(kg/ha)	*K(kg/ha)*			*Mean*
	0	*30*	*60*	
0	26.1	25.3	25.8	25.7
30	27.1	26.5	32.1	28.6
60	36.5	38.6	38.5	37.9
90	37.5	40.2	39.6	38.3
120	34.3	38.6	40.7	38.9
Mean	32.9	33.8	38.0	
CD 5%	N levels: 4.87, K levels: NS Interaction: NS			

Table 3
Residual effect of applied N and K on the yield of succeeding wheat

N(kg/ha)	*K(kg/ha)*			*Mean*
	0	*30*	*60*	
0	54.2	55.8	56.2	55.5
30	53.5	57.3	54.8	55.2
60	55.8	54.8	52.4	54.3
90	53.8	56.8	57.3	56.0
120	56.2	56.8	56.2	56.4
Mean	54.7	56.3	55.4	
CD 5%	N levels: NS, K levels: NS Interaction: NS			

The yield of succeeding wheat remained statistically at par with different levels of applied N & K. No interaction effect of N & K was also observed on yield of wheat (Table 3).

The data on K content of grain of Pusa Basmati 1509 are presented in Table 4. Significant variation in grain K content BR was observed with the application of K. The mean content of BR grain increased from 0.55% in control to 0.64 and 0.68%

Table 4
Effect of applied N and K on available potassium status of soil

N(kg/ha)	*K(kg/ha)*			*Mean*
	0	*30*	*60*	
0	140.2	154.3	164.6	153.0
30	154.3	168.1	159.9	160.7
60	135.6	145.3	167.3	149.4
90	145.3	156.8	173.4	158.5
120	148.9	154.3	167.8	157.0
Mean	144.86	155.76	166.3	
CD 5%	N levels: NS, K levels:6.7 Interaction: NS			

at 30,60 kg K_2O/ha application level respectively. The increase in mean K content of grain was significant at both 30 and 60Kg levels. However application of N did not result in any significant change in mean grain K content. No interaction effect of applied in N and K was observed on grain K content.

Table 5
Effect of applied N and K on grain K content of basmati rice

N(kg/ha)	*K(kg/ha)*			*Mean*
	0	*30*	*60*	
0	0.40.	0.54	0.64	0.59
30	0.54	0.68	0.59	0.60
60	0.56	0.65	0.67	0.63
90	0.53	0.68	0.73	0.65
120	0.59	0.67	0.78	0.68
Mean	0.55	0.64	0.68	
CD 5%	N levels: NS, K levels:0.4 Interaction: NS			

The available K of the soil was determined after harvest of wheat crop and data are presented in table 5. The mean available K of the soil did not very with levels of N application. However significant variation in available K was observed with K application. The available K content increase from 144.9 kg/ha in control to 155.8 and 166.3 kg/ha in 30 and 60 kg, K_2O/ha application levels. The increase at both 30 and 60Kg application level of K was significant as compared to control. However no interactive effect of in N and K application was observed on available K content of soil.

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