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nfluence of nitrogen and potassium on incidence of sheath rot and rop yield in rice (*Oryza sativa* L.)

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Abstract : **A field experiment was conducted during late *kharif* 1999 to study the influence of nitrogen and potassium on the incidence of sheath rot and crop yield in rice revealed that the disease incidence increased with increase in nitrogen level from 0 to 300 kg ha^{-1} while decreased with increased potassium level from 0 to 140 kg ha^{-1}, The number of infected tillers and grains were more with 300 kg of nitrogen and 0 kg of potassium and were less in plants treated with higher levels of K (140 kg ha^{-1}) irrespective of nitrogen level. Application of 300 Kg N and 140 Kg K ha^{-1} recorded significantly higher grain yield of 3909 kg ha^{-1} compared to 0 kg N and 0 Kg K ha^{-1} (2900 kg ha^{-1}). Higher grain yield of 3623 kg ha^{-1} was recorded in CV NLR 30491 compared to NLR 33633 (3288 kg ha^{-1}).**

Key words: Nitrogen, Potassium, Sheath rot, Crop yield.

ntroduction

Rice crop is constantly subjected to several ungal, bacterial and viral diseases. Among fungal iseases, sheath rot caused by *sarocladium oryzae* as assumed much importance in recent years y causing heavy yield losses. The disease as reported to cause 80-85 per cent yield loss n Andhra Pradesh. Sheath rot effected plants how reduced grain filling and results in decreased eed germination (Vidyasekharan *et al.* 1984). ll nutrients may effect plant health but nitrogen nd potassium plays a major role. Most authors gree that nitrogen decrease the crop resistance. Disease incidence increased with increase in nitrogen levels but decreased with increase in potassium application (Sekhar and Prasad, 1989). This suggests that the knowledge regarding the interaction of mineral nutrition with plant disease may be useful in understanding the influence of sheath rot of rice. Hence the present investigation was planned to study the influence of nitrogen and potassium on incidence of sheath rot and crop yield in rice.

Materials and Methods

A field experiment was conducted at the S.V.Agricultural College farm in Tirupati (Andhra Padesh) during late *kharif*, 1999 on sandy loam soil. The experiment was laid out in a factorial randomised block design with three replications The treatments consists of four levels of nitrogen (0, 100, 200, and 300 kg ha^{-1}) and 3 levels of potassium (0, 70, and 140 kg ha^{-1}). The varieties used in this study were NLR 33633 and NLR 30491. The crop was planted in an individual plot size of 2mx5m with a spacing of 20 cm x 10 cm. Different levels of nitrogen in the form of urea was applied in two splits *viz.* half the nitrogen as basal and another half at 30 days after planting. Phosphorus in the form of single super phosphate at the rate of 40 kg P_2O_5 ha^{-1} and different levels of K in the form of murate of potash was applied as basal.

The symptoms developed due to sheath rot infections were carefully observed and recorded at regular intervals based on the visual symptoms by using the disease score (Table 1). The data was recorded on number of sheath rot affected tillers per hill, number of plants affected per m^2 and number of productive tillers per panicle at regular intervals. The yield components and yield were recorded at the time of harvest.

Results and Discussion

The sheath rot intensity increased with increase in nitrogen level from 0 to 300 kg ha^{-1} and maximum disease intensity (4) was recorded at 300 kg N ha^{-1} (Table 2). Increased application of nitrogen increased the reducing and non reducing sugars resulting in increased susceptability of the crop to the pathogen (Mohan and Subramanian, 1977). Increased application of potassium from 0 to 140 kg ha^{-1} reduced the sheath not intensity and maximum reduction of disease intensity was observed at 140 kg

Table 1. Sheath rot intensity disease score grade in rice

Grade	Disease
1	Small brown lesions on boot leaf sheath and panicle emergence normal
2.	Lesions enlarge or coalesce and cover about 5 per cent of leaf sheath and panicle emergence normally
3.	Lesions cover about 6-15 per cent of leaf sheath area and 75 per cent of panicle exerted
4.	Lesions cover about 16-50 per cent of leaf sheath area and 50 per cent of panicle exerted
5.	Lesions cover more than 50 per cent of the leaf sheath and panicle emergence completely affected or only about 25 per cent of panicle exerted.

Table 2. Effect of nitrogen and potassium on sheath rot intensity (score) in rice

Treatments	Days after transplanting									
	50		60		70		80		100	
	V_1	V_2	V_1	V_2	V_1	V_2	V_1	V_2	V_1	V_2
N_0K_0	2.6	2.3	2.9	2.7	3.1	3.0	3.63	3.6	3.8	3.7
N_0K_{70}	2.2	2.0	2.6	2.5	3.0	2.8	3.3	3.1	3.4	3.4
N_0K_{140}	2.0	1.7	2.3	2.2	2.5	2.5	3.1	2.8	3.2	3.1
$N_{100}K_0$	2.8	2.6	3.0	2.1	3.3	3.3	3.7	3.4	3.8	3.3
$N_{100}K_{70}$	2.5	2.1	3.0	2.9	3.2	3.2	3,5	3.2	3.7	3.5
$N_{100}K_{140}$	2.0	2.0	2.8	2.6	3.0	2.8	3.4	3.2	3.8	3.4
$N_{200}K_0$	2.8	2.6	3.2	3.1	3.4	2.4	3.8	3.6	4.0	3.9
$N_{200}K_{70}$	2.6	2.2	3.1	2.9	3.2	3.2	3.6	3.5	3.8	3.7
$N_{200}K_{140}$	2.1	1.9	3.0	2.4	2.9	2.6	3.2	3.1	3.5	3.3
$N_{300}K_0$	2.8	2.6	3.3	3.2	3.4	3.4	3.8	3.7	4.0	3.9
$N_{300}K_{70}$	2.5	2.4	3.1	3.0	3.1	2.6	3.6	3.5	3.8	3.7
$N_{300}K_{140}$	2.0	2.0	2.8	2.8	3.0	2.9	3.3	3.3	3.6	3.5

V_1 = NLR 33633 V_2 = NLR 30491

ha^{-1} (2) irrespective of nitrogen levels. The disease intensity increased with ageing of the crop and maximum was recorded at 100 DAT in both the cultivars. The disease intensity was higher in NLR 33633 compared to NLR 30491 irrespective of nitrogen application. The reduced disease incidence in potassium treated plants might be due to the effect of potassium on the host by altering its physiological and biochemistry (Ramaswamy and Prasad, 1974) and by offering and or increasing the anatomical resistance of host (Matsobayoshi *et al.* 1963).

There were significant differences observed among the treatments regarding number of sheath rot affected tillers per hill, plants per m^2 and productive tillers per m^2 at all stages of plant growth (Table 3). The number of sheath rot affected tillers per hill and number of sheath rot affected plants per m^2 increased with increase in nitrogen application from 0 to 300 kg ha^{-1}, while decreased with increase in potassium application from 0 to 140 kg ha^{-1}. Among the treatments, application of higher level of potassium (140 kg ha^{-1}) irrespective of nitrogen levels significantly decreased the number of infected tillers per hill and plants per m^2. Similar reduction in number of affected tillers due to increased level of potassium was observed by Chen and Chu (1970). Maximum number of sheath rot affected plants were observed with 300 kg N + 0 kg K ha^{-1}.

Table 3. Effect of fertilizer nitrogen and potassium on sheath rot disease in rice.

Treatments (kg ha^{-1})	No. of sheath rot affected tillers per hill			No. of sheath rot affected plants per m^2			No.of productive tillers per m^2		
	50 DAT	70 DAT	100 DAT	50 DAT	70 DAT	100 DAT	V_1	V_2	Mean
N_0K_0	2.37	2.96	3.83	11.50	22.83	31.00	198.3	216.6	207.5
N_0K_{70}	2.1	2.53	3.40	9.67	22.83	28.50	206.6	219.3	213.0
N_0K_{140}	1.76	2.33	2.93	9.50	20.83	27.00	219.0	229.6	223.8
$N_{100}K_0$	2.30	2.90	3.80	9.33	20.67	28.83	207.3	225.6	216.5
$N_{100}K_{70}$	2.0	2.50	3.16	7.50	19.00'	25.67	225.0	235.0	230.0
$N_{100}K_{140}$	1.9	2.30	3.04	6.83	18.83	24.17	230.3	238.0	234.1
$N_{200}K_0$	2.43	2.86	3.63	12.83	25.33	32.33	206.03	224.3	215.3
$N_{200}K_{70}$	2.23	2.73	3.50	9.83	24.83	30.83	207.6	232.3	220.0
$N_{200}K_{140}$	1.83	2.30	3.69	8.0	23.00	30.0	220.3	238.6	229.8
$N_{300}K_0$	2.47	2.89	3.83	9.67	22.67	28.50	219.6	236.0	227.3
$N_{300}K_{70}$	2.16	2.67	3.53	8.0	20.50	27.33	227.3	244.0	235.6
$N_{300}K_{140}$	1.87	2.33	3.0	6.83	20.17	26.00	232.33	249.6	241.0
CD (P=0.05)	0.22	0.09	0.25	0.83	0.72	0.48	–	–	–
Varieties							216.9	232.1	
V_1 NLR 33633	2.13	2.65	3.39	8.50	20.39	27.14			
V_2 NLR 30491	2.13	2.53	3.36	9.67	23.19	29.56			
CD (P=0.05)	NS	NS	NS	2.64	1.77	1.18		2.39	
TXV	NS	NS	NS	NS				8.28	
T								5.85	

Increased application of nitrogen increased the reducing and non reducing sugars resulting increased susceptability of the crop to the pathogen (Mohan and Subramanian, 1977). Among the cultivars, NLR 30491 recorded lesser number of plants affected by sheath rot compared to NLR 33633.

The number of productive tillers per m^2 increased significantly with increase in nitrogen. Higher number of productive tillers were observed with 300 kg N and 140 kg K ha^{-1} may be due to continuous supply of nutrients for plant growth and lower number were observed with 0 kg of nitrogen and potassium per hectare. Nair *et al.* (1988) observed that foliar application of nitrogen and potassium together with carboxin reduced panicle damage by the sheath rot fungus and gave highest yields.

There was significant difference between treatments with respect to number of infected grains per panicle and number of uninfected grains per panicle (Table 4). The lowest number of infected grains per panicle was observed in 300 kg N and 140 K ha^{-1} (8.28) and highest number of infected grains was observed in 0 kg N and 0 kg K ha^{-1} (24.6). Cultivar NLR 33633 recorded higher number of infected grains per panicle (18.5) compared to NLR 30491 (15). Varietal differences were also observed in rice by Ahamed *et al.* (1974).

Sheath rot disease caused reduction in 1000 grain weight and grain yield. This may be due to reduced current photosynthesis and leaf area as the sheath rot affects the entire foliage including the boot leaf. Lakshmanan and Velusamy (1991) reported that reduction in weight of panicles, and 1000 grains weight in sheath rot infected panicles. 1000 grain weight and grain yield was more in plants treated with 300 kg N and 140 kg K ha^{-1} and lower in plants treated with no N and K application. NLR 30491 recorded higher grain yield (3623 kg ha^{-1}) compared to NLR 33633 (3288 kg ha^{-1}) The increased grain yield by higher application of potassium might be

Table 4. Effect of sheath rot on yield components of rice as influenced by different levels of nitrogen and potassium

Treatments (kg ha^{-1})	No.of grains infected per panicle			No.of grains uninfected per panicle			1000 grain weight (g)			Grain yield (kg ha^{-1})		
	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean
N_0K_0	25.13	23.00	24.61	51.93	74.67	63.30	22.46	22.82	22.64	2800	3000	2900
N_0K_{70}	24.10	18.07	21.23	44.87	55.40	51.13	22.58	22.83	22.70	3083	3333	3208
N_0K_{140}	19.60	17.33	78.83	50.80	47.60	49.77	22.69	22.83	22.76	3233	3516	3375
$N_{100}K_0$	20.63	13.20	16.92	84.8	85.20	-83.50	22.69	22.84	22.76	3183	3500	3346
$N_{100}K_{70}$	13.47	12.13	12.63	65.6	83.13	73.90	22.88	22.80	22.84	3333	3633	3483
$N_{100}K_{140}$	13.13	8.33	10.90	65.53	58.33	61.93	22.85	22.90	22.87	3366	3666	3283
$N_{200}K_0$	23.87	24.53	24.20	90.33	63.67	77.0	22.62	22.88	22.75	3200	3366	3283
$N_{200}K_{70}$	20.73	18.30	19.51	70.67	62.47	64.50	22.58	22.87	22.64	3216	3433	3325
$N_{200}K_{140}$	17.97	9.93	13.95	64.47	58.33	58.97	22.74	22.91	22.85	3366	3633	3500
$N_{300}K_0$	18.97	16.27	17.62	95.60	83.60	78.0	22.78	22.02	22.84	3383	3766	3575
$N_{300}K_{70}$	14.80	13.47	14.13	75.67	80.33	89.60	22.86	22.95	22.90	3513	4066	3759
$N_{300}K_{140}$	10.50	6.07	8.28	70.10	66.80	68.45	22.90	22.96	22.93	3553	4266	3909
Mean	18.58	15.05	–	68.37	68.21		22.72	22.89	22.81	3288	3623	
CD (P=0.05)												
V		2.559			NS			0.05			54.64	
T		6.268			14.62			0.12			113.8	
VXT		NS			NS			0.17			189.	

V_1: NLR_{33633} V_2: NLR_{30491}

lue to mobilization of phenolic compounds owards the disease portion of the plant for nhibiting the multiplication of the pathogen hereby preventing the pathogens (Ranga Reddy nd Sridhar, 1976). From these results it can e inferred that the disease intensity was more n plants applied with 300 kg N and 0 kg K while less in plants applied with 140 kg K nd 0 kg N ha^{-1}. Higher grain yield was observed n the plants applied with 300 kg N and 140 g K ha^{-1}.

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