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Influence of potassium on the *in vitro* growth and sclerotial formation of *Rhizoctonia solani* on Rice pathogen

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Abstract
The effect of different potassic salt *viz.*, potassium chloride, potassium sulphate, potassium nitrate and dipotassium hydrogen phosphate at 1.0,0.5, 0.05 and 0.01 per cent concentrations of potassium on the growth and sclerotial formation of *R. solani* was studied. It was observed that the mycelial growth was enhanced by the salts at the lower concentrations of potassium and inhibited at higher concentrations of potassium. The inhibition was maximum in the case of potassium chloride followed by potassium sulphate, potassium nitrate and dipotassium hydrogen phosphate. Potassium chloride exerted good inhibition of the mycelial growth of the pathogen at all the concentrations. Maximum percentage of inhibition was recorded as 64.63 per cent in the case of KCl at one percent concentration. Sclerotial formation was very poor with potassium chloride and potassium sulphate. Maximum inhibition of sclerotial production was observed at 0.5 per cent and 1.0 per cent production was observed at 0.5 per cent and 1.0 per cent concentration of KCl_2 and potassium sulphate respectively.

Keywords: Potassium, *Rhizoctonia solani,* sclerotial formation

Introduction
Rice is an important cereal crop, which is the primary food for half of the human population. In India it is grown in about 40.9 million ha, with an annual production of 82.5 million tonnes. In Tamil Nadu, rice is cultivated in 2.7 m.ha, with an annual production of 5-6 million tonnes. The average annual production of rice in India is 2.8 t ha^{-1}. Rice crop suffers from a number of fungal, bacterial and viral diseases. Among the fungal diseases, sheath blight is a major disease caused by *Rhizoctonia solani* Kuhn. (*Thanatephorus cucumeris* (Frank) (Donk.).
Several workers reported that potassium fertilization reduced the susceptibility of rice to diseases, hastened the maturity and increased the yield. Yamada (1959) reported that the deficiency of potassium and excess of nitrogen were responsible for the incidence of diseases like sheath blight, brown spot, blast and stem rot of rice. Kannaiyan and Prasad (1978) [3] reported that potassium application reduced the sheath blight disease of rice.

Materials and Methods
Czapek's broth was prepared, pH of the medium adjusted to 6.5 to 7.0, distributed in 50 ml quantities in 250 ml Erlenmeyer flasks. The potassic salts *viz.*, potassium chloride, potassium nitrate, potassium sulphate and dipotassium hydrogen phosphate were added at 0.01, 0.05, 0.1, 0.5 and 1.0 per cent concentrations of potassium. The flasks were inoculated with one-week-old eight mm fungal mycelial discs and incubated at room temperature (28±1°C) for 15 days. At the end of the incubation period, the biomass from the culture solution was removed by filtration under suction in a previously dried and weighed filter paper. The filter paper with the biomass was dried in 102 °C for 24 hrs. and the dry weight was recorded. The intensity of sclerotial formation in the broth was also noticed.

Composition of Czapek's broth (Ainsworth, 1961) [1]

Sodium nitrate	: 2.0 g
Dipotassium hydrogen phosphate	: 1.0 g
Magnesium sulphate	: 0.5 g
Potassium chloride	: 0.5 g
Ferrous sulphate	: 0.01 g

Sucrose : 30.0 g
Distilled water : 1000 ml
pH : 6.8-7.2

To study the effect of different potassic salts, the Czapek's medium devoid of KCl and K_2HPO_4 was prepared and P was substituted with ammonium phosphate and K with above mentioned salts.
In the same manner, potassium chloride as the source of potassium was tested at different levels corresponding to the field levels.

Sl. No.	Conc. of K	KCl present in the medium (gm/100 ml)	Corresponding K_2O levels ha^{-1}
1.	0.000000	0.000000	00
2.	0.001037	0.001978	25
3.	0.002075	0.003956	50
4.	0.003112	0.005934	75
5.	0.004150	0.007912	100

Results and Discussion
The effect of different potassic salts *viz*., potassium chloride, potassium sulphate, potassium nitrate and dipotassium hydrogen phosphate at 1.0, 0.5, 0.1, 0.05 and 0.01 per cent concentrations of K on the growth and sclerotial formation of *R. solani* was studied and their results are presented in Table 1 and Fig.1.
It was observed that, the mycelial growth was enhanced by the salts at lower concentrations of K and inhibited at higher concentrations of K. The inhibition was maximum in the case of potassium chloride followed by potassium sulphate, potassium nitrate, and dipotassium hydrogen phosphate.
Potassium chloride exerted good inhibition on the mycelial growth of the pathogen at all the concentrations. Maximum percentage of inhibition was recorded as 64.63 per cent in the case of potassium chloride at 1.0 per cent concentration. Dipotassium hydrogen phosphate and potassium nitrate enhanced the growth to the maximum extent at lower concentrations.
Sclerotial formation was very poor with potassium chloride and potassium sulphate. Whereas, potassium nitrate and dipotassium hydrogen phosphate induced the sclerotial production. Maximum inhibition of sclerotial production was observed at 0.5 per cent and 1.0 per cent concentration of potassium chloride and potassium sulphate respectively.
The growth of any microorganism is dependent on the nutritional environment. Several reports are available on the nutritional factors in relation to the growth of *R. solani*. Invariably all mineral salts induce the growth at lower or optimum concentrations and inhibit the same at higher concentrations (Porter, 1946) [5]. In the present study the salt KCl efficiently inhibited the growth and sclerotial formation at all the concentrations. The maximum inhibition of growth and sclerotial production was noticed with KCl, followed by K_2SO_4, KNO_3 and K_2HPO_7.
Highest inhibition was recorded as 64.63 per cent in the case of KCl at 1.0 per cent concentration of potassium. This reduction in mycelial growth may be due to the imbalance caused by very high concentration of one cationic nutrient in relation to others.
Similar results were obtained by Ramasamy (1974) [7] with melon wilt fungus *Fusarium oxysporum* f.sp *melonis*. Salle (1973) [8] also found chloride to be more toxic to growth from SO_4, or NO_3. In this experiment K_2HPO_7 and KNO_3 were found to support growth and sclerotial production at lower concentrations. These findings are in line with the results of Prabakaran (1974) [6], Kasirajan (1975) [4] and Jayaraj (1989) [2].

Table 1: Effect of different sources of potassium on the *in vitro* growth and sclerotial formation of *Rhizoctonia solani*

Sl. No.	Potassium sources	Per cent concentration	Mycelial* dry weight (mg/50 ml)	Per cent decrease (-) or increase (+) over control	pH
1.	KCl	1.0	244	-64.63	6.9
		0.5	349	-49.42	7.0
		0.1	455	-34.05	6.9
		0.05	563	-18.40	7.0
		0.01	668	-3.18	7.1
	SE CD (p=0.05)		0.3416 0.9709		
2.	K_2SO_4	1.0	251	-63.62	7.0
		0.5	359	-47.97	7.1
		0.1	461	-33.18	6.9
		0.05	566	-17.97	7.1
		0.01	671	-2.75	7.0
	SE CD (p=0.05)		2.5232 5.0717		
3.	KNO_3	1.0	260	-62.31	6.9
		0.5	362	-47.53	7.0
		0.1	473	-31.44	7.1
		0.05	575	-16.66	7.1
		0.01	677	-1.88	7.0
	SE CD (p=0.05)		2.3783 1.1832		
4.	K_2HPO_4	1.0	265	-61.59	6.9
		0.5	369	-46.52	7.0
		0.1	472	-31.59	7.1
		0.05	576	-16.52	7.1
		0.01	681	-1.30	7.0
	SE CD (p=0.05)		0.7528 2.1398		
5.	Control		690		

* Mean of three replicates

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