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EFFECT OF CERTAIN MACRO-MICRO NUTRIENTS ON BROWN LEAF SPOT OF RICE CAUSED BY *HELMINTHOSPORIUM ORYZAE* (*BIPOLARIS ORYZAE*) BREDA DE HAAN

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Abstract

Seven macro-micro nutrients *viz.,* calcium sulphate, copper sulphate, ferrous sulphate, magnesium sulphate, potassium sulphate, manganese sulphate and zinc sulphate were sprayed @ 1.0, 2.0 and 3.0 % conc. individually at disease initiation and repeated once at fifteen days interval in ADT 36 rice variety. Among the seven nutrients tested, $ZnSO_4$ at three per cent level was the most effective over the other nutrients followed by potassium sulphate at three per cent in reducing disease incidence as compared in control and increases the grain yield. $MgSO_4$ at three per cent was least effective

Key words: Macro-micro nutrients, Brown spot of rice, Per cent disease index

Introduction

Rice, which is being cultivated for several years in our country, it is not just a grain, it is the lifeline and is the second most important crop next to wheat. India is one among the leading producer of rice in Asia (Tony Cisse, 2005). Rice crop has been under cultivation from time immemorial, being grown under varying climatic conditions in different parts of the country. It is widely affected by quite a number of diseases caused by fungi, bacteria, viruses and mycoplasma which results in higher yield losses (Ou, 1985).

Rice crop is widely affected by a number of diseases caused by fungi, bacteria, viruses and mycoplasma which results in considerable yield losses (Ou, 1985). Among the various fungal diseases of rice, brown spot or sesame leaf spot incited by *Helminthosporium oryzae* (Breda de Haan) Subram. and Jain (Syn: *Bipolaris oryzae* (Breda de Haan) Shoemaker) is found to occur in most rice growing areas.

Normally fungicides are primary means of controlling plant diseases. But the use of chemical fungicides is under special scrutiny for posing potential environmental threat as the indiscriminate use of chemical fungicides resulted in environmental pollution and ill-health to biotic community as a whole. Even if acceptable fungicides are applied the pathogen often develops resistance and produce new biotypes. The increased consumer preference for healthy agricultural products and environmental risks associated with chemical residues in food are the major driving forces for the search of new safer control methods.

Biological management of plant pathogens by the use of antagonistic microorganisms is a potential non-chemical means and is known to be cheap and effective. But, the level of acceptance of existing microbial and bioprotectants by the farming community is less than one per cent of the total pesticide market share (Greaves, 2009; Deliopoulos *et al.,* 2010). So, a need was felt to develop novel, more effective and sustainable disease management programs which do not harm the environment at the same time increase yield and improve product quality (Dordas, 2008). Therefore, with an aim to develop for involving the use of certain macro-micro nutrients for the successful sustainable management of rice brown spot.

Materials and Methods

Chemicals

All the chemicals used in the studies were of analytical grade (A.R.) quality and glass dist. water was

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used throughout the studies.

Crop, Variety and Source

Crop : Rice (*Oryza sativa* L.)

Variety : ADT 36

Source : Tamil Nadu Rice Research Institute (TRRI), Aduthurai, Tamil Nadu.

Pot culture studies

Separate pot culture studies were conducted to test the efficacy of certain macro-micro nutrients for assessing their influence on the incidence of brown spot of rice. The brown spot susceptible variety ADT 36 grown in rectangular pots of size, 30 × 45 cm was used for the study. The plants were given artificial inoculation by spraying the spore suspensions with adequate spore load (50,000 spores/ml) at 15 DAT in the evening hours. The crop was maintained in a poly house with frequent spraying of water to provide adequate moisture and relative humidity to enable successful infection by the pathogen. The experiments were conducted in a randomized block design with three replications for each treatment and a suitable control. The fungicide carbendazim 50 WP @ 0.1 per cent was used for comparison and the standard agronomic practices as recommended by the State Agricultural Department were followed.

Evaluation of macro-micro nutrients for the management of *H.oryzae*

Seven macro-micro nutrients *viz.,* calcium sulphate, copper sulphate, ferrous sulphate, magnesium sulphate, potassium sulphate, manganese sulphate and zinc sulphate were sprayed @ 1.0, 2.0 and 3.0 % conc. individually at disease initiation and repeated once at fifteen days interval.

The disease index was assessed by adopting 0-9 scale according to "Phytopathometry" by Mayee and Datar (1986) and the per cent disease index was calculated based on the formula suggested by Vidhyasekaran *et al.*

Disease Severity	Description of Disease Index
0	No lesions
1	Affected leaf area less than 1 %
3	1-10 % affected leaf area
5	11-25 % affected leaf area
7	26 -50 % affected leaf area
9	> 50 % leaf area affected

$$\text{Per cent Disease Index} = \frac{\text{Total ratings}}{\text{Total number of leaves graded} \times \text{Maximum grade in the score chart.}} \times 100$$

(1989).

Results and Discussion

Effect of foliar application of certain macro-micro nutrients on *H. oryzae*

The results of pot culture experiments showed that all the macro-micro nutrients tested reduced the disease incidence when compared to control. Among the seven nutrients tested, $ZnSO_4$ at three per cent level was the most effective (22.46 %) over the other nutrients followed by potassium sulphate at three per cent in reducing disease incidence (25.77 %) as compared to 63.72 % observed in control and increases the grain yield. $MgSO_4$ at three per cent was least effective (Table 1). However, the test fungicide was the most effective when compared to other macro-micro nutrients for reducing the disease incidence. In general, yield was significantly higher in macro-micro nutrient treated plots when compared to Carbendazim treated and control plots.

Mineral nutrition has long been recognized as an important component of disease management practices (Huber and Wilhelm, 1988). Mineral nutrition can result in a profound effect on disease development, with fertilizer application increasing or decreasing the development of diseases caused by different pathogens (Walters and Bingham, 2007). A promising alternative control for many rice diseases, including brown spot, is a balanced nutrition (Carvalho *et al.,* 2010). Over the past 100 years, the development and use of foliar liquid fertilization has evolved (Totten *et al.,* 2008). Foliar application of various macro and micro nutrients have been proved valuable and is a relatively new technique of feeding crops by applying liquid fertilizer directly to their leaves and also develop resistance against pest and diseases (Baloch *et al.,* 2008).

Some of the resistant varieties may become susceptible due to leaching down of the elements like K, Fe, Zn and Mn which are known to be essential for resistance to *H. oryzae* (Singh, 2005). Zinc and manganese play an important role in plant physiology as cofactors of many enzymes, whereas boron is a structural component of plant cell walls (Brown *et al.,* 2002). Without micronutrients as a "spark blug", the enzyme system in crop plants would simply be an inert mass of proteins (Gupta *et al.,* 2008).

Shivay *et al.* (2008) reported the superiority of $ZnSO_4$ over the other macro-micro nutrients in managing various rice pathogens. The findings of Alagarsamy (1985) who reported that micro nutrient spray during tillering and boot leaf stage of rice reduced sheath rot disease incidence lend support to the present observation.

Table 1: Effect of foliar application of certain macro-micro nutrients on brown spot incidence and grain yield of rice var. ADT 36 (pot culture experiment)

Sl. No.	Macro-Micro nutrients		Disease index (%)	Yield (g/pot)
	Nutrients	Conc.		
1.	Calcium sulphate	1 %	35.12	32.34
		2 %	31.06	32.60
		3 %	27.54	33.09
2.	Copper sulphate	1 %	37.39	32.03
		2 %	34.55	32.39
		3 %	31.92	32.76
3.	Ferrous sulphate	1 %	41.74	31.80
		2 %	38.02	32.20
		3 %	35.93	32.47
4.	Magnesium sulphate	1 %	44.16	31.02
		2 %	40.39	31.65
		3 %	38.21	32.39
5.	Potassium sulphate	1 %	33.43	32.53
		2 %	30.57	32.90
		3 %	25.77	33.18
6.	Manganese sulphate	1 %	46.82	30.78
		2 %	41.35	31.34
		3 %	37.02	32.03
7.	Zinc sulphate	1 %	32.58	32.68
		2 %	27.65	33.01
		3 %	22.46	33.66
8.	Carbendazim (0.1 %)		14.56	30.67
9.	Control		63.72	25.72
	C.D. (p=0.05)		1.19	0.53

Also $CaSO_4$, $MnSO_4$ and $FeSO_4$ have been found effective in managing rice diseases (Ramabadran and Velazhahan, 1988; Eswaran and Narayanasamy, 2000; Ragavan, 2003). Sanjana *et al.* (2005) observed that rust disease could be managed effectively with foliar application of manganese sulphate. Magnesium sulphate enhanced the inhibition of *Alternaria alternata* under field conditions (Feng *et al.,* 2008). Sanjana and Koti (2006) observed lesser incidence of rust disease in soybean due to the application of manganese and boron as compared to other micronutrients. The results of present study are in agreement with these earlier reports.

In the present study the grain yield was significantly higher in nutrient treated plots with the maximum yield recorded in $ZnSO_4$ (3%). Application of micronutrient-enriched fertilizers can be a short-term and complementary strategy to improve the productivity food crops (Stalin *et al.,* 2011). The earlier reports by Wang *et al.* (1980); Lee *et al.* (1981) and Alagarsamy (1985) clearly showed that micro nutrients positively influenced the growth and yield characters of disease affected plants. The enhanced disease suppression might be due to positive influence of micronutrients against the pathogen growth and induced resistance against brown spot disease in the rice plants. Also, it has been suggested that low conc. of micro nutrients can induce systemic acquired resistance (Reuveni and Reuveni, 1998). In this context, use of macro-micro nutrients for plant disease management seems to be the promising alternative to chemical fungicides in managing the brown spot disease.

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