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EFFECT OF TILLAGE PRACTICES ON THE POPULATION AND VIABILITY OF SCLEROTIA OF *SCLEROTIUM ORYZAE* AND YIELD OF RICE

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Abstract

Effect of tillage practices on population and viability of sclerotia of *Sclerotium oryzae* and yield of rice was examined. Maximum tillage showed complete loss in viability of sclerotia at 0-5 cm soil surface and at (15-20 cm) depth. Yield of rice increased by 59% in maximum tillage as compared to minimum and no-tillage treatments.

Introduction

Sclerotium oryzae Catt., the cause of stem rot disease of rice is widely distributed in rice growing areas of the world (Ou, 1972). Loss in yield as high as 72% have been recorded in rice growing areas of the Punjab in Pakistan (Shafi, 1970). The disease causes increased tillering, unfilled panicles, chalky grain and widespread lodging of the plants (Cralley, 1936; Misawa & Kato, 1962; Tisdale, 1921). The sclerotia produced by the fungus serve as the primary source of inoculum which float on the surface of rice paddy water, germinate on the leaf sheaths and then enters into the culms where it produces sclerotia (Bockus *et al.*, 1978). Whereas resistant cultivars are not available, attempts to control stem rot disease by burning of rice residues (Webster *et al.*, 1976), using biological antagonists (Gupta *et al.*, 1983) and chemical fungicides (Hori & Izuka, 1951; Shioyama *et al.*, 1964) have been limited. There are reports that tillage practices directly influence the physical and chemical properties of soil, soil moisture, soil temperature, root growth, nutrient uptake, population of plant pathogen and biological activity (Gebhardt *et al.*, 1985; Summer *et al.*, 1986). In the present paper, the effect of tillage practices on the reduction in numbers and viability of sclerotia of *S. oryzae* is presented.

Materials and Methods

An experiment was carried out at Kala Shah Kaku, Rice Research Institute, Lahore, where rice-wheat-rice crop rotation is generally followed. Soil (clay loam, pH 7.2) naturally infested with sclerotia of *S. oryzae* @ 6 scl./50g of soil was tilled 2 times (minimum tillage), 4 times (maximum tillage) by a cultivator as compared to no tillage. Rice cv. Jhona-349 susceptible to *S. oryzae* was transplanted in July, 1986. The treatments were replicated 3 times in a randomized block design. After tillage and at harvest, the population of sclerotia was estimated from (0-5 cm) surface soil and 15-20 cm depth using wet sieving and floatation technique and its viability tested by transferring the sclerotia on water agar at 30±2°C (Usmani & Ghaffar, 1974). The crop was harvested and yield determined using the formula:

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$$\text{Average weight at 14\% moisture level} = \frac{\text{Total weight of yield x 100-moisture of grain}}{\text{Standard moisture (86\%)}}$$

Results and Discussion

Maximum tillage significantly reduced the population of sclerotia from surface soil as compared to no-tillage or minimum tillage ($p < 0.05$). Population of sclerotia at depth reduced significantly in all treatments. Viability of sclerotia increased 4.5 folds in no-tillage treatment. Minimum tillage resulted in significant reduction in viability ($p < 0.05$) whereas maximum tillage completely eliminated the viability of sclerotia in soil both at surface and in depth (Table 1).

Table 1. Effect of tillage on the population and viability of sclerotia of *Sclerotium oryzae* and yield of rice.

Treatments	Pop (Scl/50g of soil)				Viab %				Yield
	A.T		A.H		A.T		A.H		t/ha
	S	D	S	D	S	D	S	D	
No-tillage	5	6	4	1	8	0	36	0	3.60
Min-tillage	4	6	4	1	33 *	0	15 *	0	3.33
Max-tillage	8 *	5	4	2	20	43 *	0 *	0	5.74 *

* = Significantly different from their respective no-tillage treatment at 5% level.

Pop = Population, Viab% = Viability %, A.T = After tillage,

A.H = At harvest, S = surface, D = depth.

In the present studies, a general decline in number of sclerotia and loss in viability was observed at depth as compared to surface layer. Similar result was obtained where more sclerotia of *S. oryzae* with greater viability were found on surface soil than at 15-20 cm depth (Usmani & Ghaffar, 1974). It would therefore, suggested that deep ploughing and turning of the soil over might alleviate damages caused by *S. oryzae*.

In another report Webster *et al.*, (1976) found that mold plough resulted in burying a high percentage of sclerotial inoculum rendering it unavailable for infection since the sclerotia do not reach the surface of paddy water which is the site of infection. The population of *Rhizoctonia solani* in top soil are probably influenced more by tillage practices than any other soil borne pathogen because *R. solani* is sensitive to high level of CO_2 and population of pathogen decline in buried debris (Sumner *et al.*, 1986). Subsoiling also reduced the soil compaction and allowed roots to proliferate below the plough layer resulting in greater yields of Red Mexican bean. In our experiment similar results were obtained where maximum tillage showed upto 59% increase in yield of rice as compared to no tillage or minimum tillage.

In the present study, viability of sclerotia reduced and yield of rice increased by maximum tillage. This practice can be recommended to the farmer for elimination of sclerotia from field resulting in control of stem rot of rice and increased crop productivity.

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