

SHORT COMMUNICATION

Effect of Conservation Agriculture Based Rice-Wheat System on Sheath Blight and Spot Blotch Diseases In Eastern India

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Effect of conservation agriculture based rice-wheat system on Sheath Blight and Spot Blotch diseases in Eastern India

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Conservation agriculture has emerged as an effective strategy to achieve goals of sustainable agriculture which has the potential to protect our environment, soil and water resources while enhancing system productivity. But changing the tillage practice can lead to changes in the physical and chemical properties of soil which in turn is likely to influence the occurrence of plant diseases. A study was conducted to evaluate the influence of tillage systems on the incidences of Sheath blight of rice and Spot blotch of wheat for consecutive four years under rice-wheat system in northern parts of West Bengal. Results showed that in the initial years, zero tilled fields had higher (19%) severity of Sheath blight of rice in the first year and after fourth year the difference is non-significant. However, no consistent trend was recorded regarding severity of Spot blotch of wheat between zero tillage and conventional tillage. In some years, zero tillage had less disease severity irrespective of varieties.

Key words: Conservation agriculture, rice-wheat, disease severity, Sheath blight, Spot blotch

INTRODUCTION

Until recently, conventional tillage is the common practice in most agricultural land. However, in the last two decades or so, several developments in the field of agriculture have dictated drastic changes in tillage practices (Gupta and Sayre, 2007; Erenstein, 2008). Conservation agriculture has emerged as an effective strategy to achieve goals of sustainable agriculture worldwide (Abrol and Sanger, 2006, , Joshi *et al.* 2007; Jat *et al.* 2013, 2015; Derpsch *et al.* 2015) Any major shift in tillage practices, such as the one to reduce or eliminate tillage, profoundly impacts the microenvironment in which the crop is grown. This, in turn, greatly affects the types of plant pathogens that proliferate under the new environment. Many plant pathogens increase to damaging levels under minimum tillage conditions and become major constraints to efficient, profitable farming. The reduced tillage affects

plant diseases both directly and indirectly. They directly affect the physical and chemical properties of the soil, the soil environment, plant growth, the survival and viability of plant pathogens. Indirectly they may alter cropping practices such as fertilizer application, weed control, planting method and date of sowing etc. which may shift population of soil microbiota associated with the rhizosphere or crop residue. In that context, a study was conducted on the impact of zero tillage on the incidence and severity of diseases in rice-wheat sequences at different locations of northern parts of West Bengal for consecutive four years.

MATERIALS AND METHODS

The study was undertaken at experimental plots of Uttar Banga Krishi Viswavidyalaya, Pundibari, Coochbehar and Regional Research Sub-Station, UBKV, Manikchak, Malda districts of West Bengal, having different agro-climatic situation in the years from 2010 to 2013. The different varieties of rice

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and wheat were sown with standard agronomic practices by conventional tillage and zero tillage machine by keeping residue of the previous crop @ 2 t/ha. The plot size was 8mX 3m with three replications.

Four varieties of wheat viz. Sonalika, NW2036, HD2733, PBW343 and four varieties of rice, Arize 6444 (hybrid), PHB71 (hybrids), Nilanjana and MTU1001 were sown both in zero-till and conventional tillage conditions in the same date with same agronomic practices.

Estimation of Spot blotch disease of wheat

The severity of the disease was visually scored the double digit scale (00-99). The data on disease index was taken in the whole experimental plots to assess wheat Spot blotch diseases. The double digit scale was developed as a modification of Saari and Prescott's severity scale to score foliar disease of wheat plants. Area Under Disease Progress Curve (AUDPC), measures the amount of disease as well as the rate of progress, was calculated. The value of AUDPC was estimated using the mid point rate or so-called trapezoidal integration method. The AUDPC has no units.

$$\text{AUDPC} = \sum_{i=1}^{n-1} [(x_i + x_{i+1})/2] (t_{i+1} - t_i)$$

where, x_i is the foliar blight severity on i th date, the t_i is the i th day and n is the number of scoring days.

Estimation of Sheath blight disease of rice

Disease severity of rice was evaluated with the help of Sheath blight disease grading SES scale as developed by Directorate of Rice Research, Hyderabad, India. The scale are as follows: 0-no infection, 1- vertical spread of the lesions up to 20% of plant height, 3- vertical spread of the lesions up to 21-30% of plant height, 5- vertical spread of the lesions up to 31-46% of plant height, 7- vertical spread of the lesions up to 46-65% of plant height, 9- vertical spread of the lesions more than 66% of plant height. The per cent disease index (PDI) was calculated by using the formula:

$$\text{PDI} = \frac{\text{Sum of all disease rating} \times 100}{\text{Total no. of observations} \times \text{maximum rating}}$$

RESULTS AND DISCUSSION

Rice: The severity of Sheath blight caused by *Rhizoctonia solani* was higher (19%) in zero-tilled fields than conventional tillage in the initial year when mean of all four varieties were considered (Table 1). From second year onwards, there was no significant differences ($P=0.05$) in disease incidence, even in third year, the zero tilled plots had less disease than conventional tillage. Among the different varieties, MTU1001 was most susceptible against Sheath blight pathogen irrespective of tillage practices.

Wheat: The incidence and severity of Spot blotch caused by *Bipolaris sorokiniana* in four popularly cultivated varieties of eastern India over the years is given in Table 2.

The data in Table 2 indicates that over the four years, the effect of tillage systems on Spot blotch were not significant, although there is a tendency for the disease to be slightly greater under zero tillage. Higher severity of Spot blotch were observed under ZT in 2010-11 crop season except HD 2733. Later, there was no consistent trend recorded. Among the four varieties, Sonalika was most susceptible.

In Ontario, Canada consecutive crops of wheat promoted tan spot and *Septoria nodorum* blotch under reduced tillage, but leaf blotch caused by *S. tritici* increased under conventional tillage. It was reported that higher severities of tan spot and *Septoria* blotch of wheat and scald of barley with increases in surface residues in numerous fields in Australia. It was observed that neither the tan spot nor scald pathogens have spore dispersal mechanisms for successful spread of spores over long distances to other fields; thus, infections were limited to the fields which had residue. Singh *et al* (2005) observed higher incidence of Foliar blight incidence of wheat and Sheath rot of rice in zero tilled field than conventional tillage. However, the adoption of Resource Conservation Technology was not adversely affected soil biology in Indo-Gangetic plains. Numerous fungal microorganisms, including several indicators of biocontrol activity were observed in soil profiles which indicate that there is little risk of inoculum build-up of rice or wheat pathogens or significant carry-over between the two crops leading to new biotic constraints and it endorse the promotion of zero tillage and other

Table 1 : Effect of zero tillage on Sheath Blight disease of rice caused by *Rhizoctonia solani*

Variety	2010		2011		2012		2013	
	CT	ZT	CT	ZT	CT	ZT	CT	ZT
Nilanjana	25.9	35.8	29.1	31.4	23.1	25.6	26.3	27.9
Arize 6444	31.7	39.6	27.8	29.9	31.7	29.8	29.8	29.5
PHB71	37.8	41.3	32.3	35.1	33.1	34.5	31.1	32.3
MTU1001	56.4	64.9	47.8	45.8	47.2	43.1	45.6	45.2
Mean	37.95	45.4	34.25	35.55	33.78	33.25	33.20	33.72

CD at 5%: Variety= 3.572; Tillage= 2.763

CT=Conventional tillage; ZT=Zero tillage

Table 2 : Effect of zero tillage on Spot Blotch of wheat caused by *Bipolaris sorokiniana*

Variety	Tillage	Spot Blotch Severity (AUDPC)				
		2010-11	2011-12	2012-13	2013-14	Mean
PBW343	CT	462.96	361.11	516.30	423.98	441.08
	ZT	603.70	546.30	422.96	451.67	506.16
HD2733	CT	666.67	675.93	398.15	431.21	542.99
	ZT	432.96	616.67	361.11	437.86	462.15
NW2036	CT	546.30	656.67	407.40	412.24	505.65
	ZT	768.52	685.21	341.11	417.42	553.06
Sonalika	CT	907.41	1000.03	977.41	967.29	963.03
	ZT	1150.02	824.07	1027.8	890.76	973.16

CD at 5%: Variety= 26.789; Tillage= 31.235

CT=Conventional tillage; ZT=Zero tillage

resource conserving technologies. The present results also substantiate the above observation.

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