Management of Leaf Blight (*Bipolaris sorokiniana*) Disease of Wheat with Cultural Practices

Prem CP Chaurasia[1] and Etienne Duveiller[2]

[1] Regional Agriculture Research Station, Tarahara, Sunsari, Nepal
[2] CIMMYT, Kathmandu

ABSTRACT

An experiment was conducted at agronomy farm of Agriculture research Station, Tarahara, Nepal for three consecutive years viz 2000/2001,2001/2002, and 2002/2003 to evaluate the effects of different cultural practices on leaf blight diseases of wheat caused by *Bipolaris sorokiniana* under terai conditions. The experiment was conducted in factorial Randomized Complete Block Design with four replications. Four factors, two wheat verities RR-21 and Nepal 297,two number of irrigations (two and three irrigations), two doses of Nitrogen fertilizer viz. 60kg N/ha and 120 kg N/ha and two dates of sowing of wheat were examined. Different yield components, grain yield (kg/plot) and disease severity were recorded to judge the effects of these factors on severity of leaf blight of wheat. Nepal Line 297 had significantly less AUDPC based on flag leaf infection and whole plan as compared to RR-21. Number of irrigations had no significant effect on AUDPC, as there was frequent rain during experimental period. Doses of Nitrogen fertilizer had significant effect on AUDPC based on flag leaf infection. It was higher in case of 60 kg N/ha. The third week of November sowing of wheat had lower value of AUDPC as compared to December sowing. Plant height, panicle lengths were highly significantly higher in case of RR-21 as compared to Nepal-297. Thousand kernel weight, and grain yield kg/ha were significantly higher in Nepal-297. All agronomic parameters except thousand kernel weight and number of tillers/plan were significantly higher in 120kg N/ha. The third week of November sowing of wheat had less plant height and panicle length, higher thousand kernel weight and more grain yield. Leaf blight severity was highly significantly less in case of Nepal-297. Doses of Nitrogen fertilizer had significant effect on plant height, panicle length, thousand kernel weight, percentage flag leaf infection and AUDPC based on flag leaf infection. Based on the results of three years of experimentations, it can be concluded that Nepal-297 had less disease, number of irrigations had no effect on disease severity, higher doses of nitrogen fertilizer had less flag infection and late sowing of wheat also had less disease. Numbers of irrigation's effects were inconclusive as there were frequent rains during experimentation period. Based on above conclusion, it is recommended that growing wheat verity like Nepal-297, use of higher doses of nitrogen fertilizer and sowing of wheat / first week of Dec help in minimizing the severity of leaf blight. However late sowing had lowered grain yield.

Key words: AUDPC, culture practices, disease management, leaf blight

INTRODUCTION

Wheat *(Triticum acstivum* L.) is one of the most important winter crops in eastern terai. In 2001/2002 there was wheat in 6670,077 ha all over in the Nepal with the total production of 1258045 tons. In the same year it was cultivated in 123,479 ha in the Eastern Development Region with total production of 242579 tons. In eastern terai it was cultivated in 89,334 ha with production of 188,240 tons and average productivity was 2107 kg. The most of the acreage of the wheat of eastern terai is covered by wheat verities such as Nepal-297, RR-21, UP-262 and others. These verities are prone to heavy attack of the diseases called leaf blight that is caused by Bipolaris sorokiniana (telcom. *Cochlobolus sativus*). These diseases are widely distributed through out wheat growing areas of the country particularly in terai (NWRP 1996). Since its first record, the disease severities have been increased and are found to affect

the leaves of the most commercial wheat verities (Karki and Horsford 1986). Magnitude of yield loss due to the disease may vary among locations and years. A disease incidence of up to 90% on cv-RR-21 was recorded in terai belt (NWRP 1977). The highest grain yield loss was reported for RR-21, which ranged between 23.2% and 23.88%. A yield loss in Nepal-297 recorded at Bhairahawa was 15.2% (Shrestha et al 1998). Several fungicides including Bavistin (mothyl benzimidazol-2-ylearbamate), Benlate (methyl1- (butylearbmoy) benzimidazol-2-ylearbamate), Dithane M-45 (zinc ethyle bisdithiocarbamate) were tested as foliar spray to control the disease in Nepal. (NWRP 1977, Bimb 1979). Tilt (propiconazole) was also found to be quite effective in reducing leaf blight. However, it is expensive and not easly available in Nepalese market. (Mahato and Sedhai 1994).

It is generally accepted that resistance of high yielding genotypes is not yet satisfactory (Duveiller et al 1998). The application of two irrigations reduced the severity of foliar blight as compared to no irrigation (Shrestha et al 1998). Ruckstuhl (1998) reported that low or imbalance soil nutrient levels predispose plants to more severe leaf blight attack. Singh et al (1998) found low incidence of disease when wheat crop was sown on 30th Nov. as compared 20th Dec. With above in formations, this study was undertaken to determine, the effects of different cultural practices such as wheat genotypes, doses of nitrogen fertilizer, number of irrigations and dates of wheat sowing on severity of leaf blight under terai condition.

MATERIALS AND METHODS

The experiment was conducted using factorial Randomized Complete Block Design for three consecutive years: 2000/ 2001, 2001/2002, and 2002/2003 at Regional Agriculture Research Station, Tarahara, Sunsari, Nepal. There were four replications. The plot size was 4- × 3-m. The four factors were two wheat genotypes (RR- 21 and Nepal-297), two numbers of irrigations (two and three), two doses of Nitrogen (60 kg N/ha and 120 kg N/ha) and two dates of wheat sowing (3rd week of Nov and first week of Dec). Phosphorous and potash were applied at the rate of 40 kg/ha each as basal. Half of the nitrogenous fertilizer was applied as basal and remaining half as fist top dressing after 30 days of wheat sowing. There were sixteen treatments combinations in each replication. Plants height in cm. (five plants from each plot of each treatment), number of tillers/plant (five plants from each plot), thousand kernel weight in gram, grain yield/ plot in kg, disease score at three times based on whole leaves and flag leaf infection were recorded using double digits methods (Duveiller 2000). Area under Disease Program Curve (AUDPC) was calculated using Shanner and Finney (1998) method. Data were analyzed using MSTAT-C computer program.

RESULTS AND DISCUSSION

Effect of genotypes on yield, yield components and disease

In first year of experimentation, there was no significant effect of genotypes on AUDPC based on whole plans scoring but there was highly significantly less AUDPC based on flag leaf infection in case of Nepal-297. Thousand kernel weight was significantly more in Nepal-297. All other parameters except plant height were non significant. In second years of experimentation all parameters were highly significantly different (Table 1).

Number of tillers/plant, thousand kernel weight, and grain yield/ plot were higher in case of Nepal-297. Panicle length, AUDPC based on whole plant, percentage terminal disease, AUDPC based of flag leaf infection were less in Nepal-297 (Table 2).

Table 1. Effect of different factors on disease components and yield of wheat in 2000/2001

	Factors	Plant height, cm	No of tillers/plant	Panicle length, cm	Thousand grain wt, g	Grain yield/plot, kg	Disease		
							AUDPC total leaf	% Flag leaf inf.	AUDPC flag leaf
1	**Varity**								
	RR-21	95.9	4.1	7.9	37.2	1.9	1115.1	50.0	401.3
	Nepal-297	85.2	3.9	7.7	44.0	2.0	1132.8	48.8	33.0
	Significance	**	ns	ns	**	ns	ns	ns	**
2	**No of irrigations**								
	Two irrigations	90.7	4.1	7.9	40.7	1.9	1113.3	49.8	362.4
	Three	90.3	3.9	7.8	40.6	1.9	1134.6	48.9	341.9
	Significance	ns	ns	ns	ns	ns	ns	ns	
3	**Doses of fertilizer**								
	60 kg N/ha	90.1	3.8	7.8	40.5	1.7	114.5	50.0	366.2
	120 kg N/ha	91.0	4.1	7.9	40.8	2.1	1102.7	48.8	338.1
	Significance	ns	*	ns	ns	**	ns	ns	*
4	**Date of sowing**								
	Mid Nov sowing	92.1	4.3	7.9	42.5	2.4	1150.7	52.0	421.2
	1st week of Dec sowing	89.0	3.8	7.7	38.8	1.5	1097.2	46.7	283.0
	Significance	**	**	ns	**	**	**	**	**

Table 2. Effect of different factors on leaf blight disease, yield and yield components in 2001-2002

	Factors	Plant height, cm	No of tillers/ plant	Panicle length, cm	Thousand grain wt, g	Grain yield/plot, kg	Disease		
							AUDPC total leaf	% Flag leaf inf.	AUDPC flag leaf
1	**Varity**								
	RR-21	100.3	6.	10.7	40.1	1.809	476.6	29.2	153.0
	Nepal-297	90.9	7.8	9.5	45.7	2.621	426.6	20.7	102.8
	Significance	**	**	**	**	**	**	**	**
2	**No of irrigations**								
	Two irrigations	95.8	7.5	10.3	42.9	2.220	443.8	28.0	144.5
	Three	95.4	7.3	9.9	42.7	2.230	459.4	21.9	111.4
	Significance	ns	ns	ns	ns	ns	ns	**	
3	**Doses of fertilizer**								
	60 kg N/ha	94.4	7.4	9.8	43.8	2.182	462.5	30.4	158.2
	120 kg N/ha	96.8	7.4	10.4	41.9	2.248	440.6	19.4	97.7
	Significance	*	ns	**	**	ns	ns	**	**
4	**Date of sowing**								
	Mid Nov sowing	94.3	7.5	9.5	45.7	2.322	467.0	33.6	172.5
	1st week of Dec sowing	96.9	7.3	10.7	40.0	2.108	435.0	16.3	83.4
	Significance	*	ns	**	**	*	ns	**	**

In third year of experimentation, all parameter except number of tillers and AUDPC based on whole plant were highly significant and Nepal-297 had less plant height, an panicle length, more thousand kernel weight, and grain yield/plot, less terminal disease score and AUDPC based on flag leaf infection (Table 3).

AUDPC based on whole plant was not significantly different between genotypes because RR-21 is leaf blight susceptible and Nepal-297 was moderately susceptible wheat verities. Chaurasia (1997) reported that from yield loss point of view flag leaf infection is more important. AUDPC based on flag leaf infection was highly significantly less in case of Nepal-297 as compared to RR-21 (Figure 1).

Table 3. Effect of different factors on disease components and yield of wheat in 2002/2003

	Factors	Plant height, cm	No of tillers/ plant	Panicle length, cm	Thousand grain wt, g	Grain yield/plot, kg	Disease		
							AUDPC total leaf	% Flag leaf inf.	AUDPC flag leaf
1	**Varity**								
	RR-21	100.2	3.5	10.2	43.2	2.266	1204.6	47.5	600.6
	Nepal-297	82.2	3.5	9.3	46.8	2.508	1171.8	40.9	550.5
	Significance	**	ns	**	**	**	ns	**	**
2	**No of irrigations**								
	Two irrigations	96.1	3.4	9.8	45.1	2.353	1181.3	47.7	577.9
	Three	96.2	3.5	9.7	44.8	2.240	1195.3	44.6	593.1
	Significance	ns	ns	ns	ns	ns	ns	ns	ns
3	**Doses of fertilizer**								
	60 kg N/ha	94.3	3.1	9.4	45.7	2.127	1260.9	46.8	637.2
	120 kg N/ha	98.1	3.9	10.1	44.3	2.647	1115.6	45.6	533.9
	Significance	**	**	**	**	**	**	ns	**
4	**Date of sowing**								
	Mid Nov sowing	94.3	3.5	9.6	15.8	2.228	1296.8	46.5	655.6
	1st week of Dec sowing	98.1	3.5	9.8	44.2	2.545	1079.8	45.8	515.5
	Significance	**	ns	ns	**	**	**	*	**

Figure 1. Area Under Disease Progress Curve value based on flag leaf infection of two genotypes in different years at Tarahara.

Therefore, it is expected that yield loss due to disease will be less in Nepal-297 as compared to RR-21.Shrestha et al (1998) reported more yield loss in RR-21 as compared to Nepal-297. This is inconformity of our finding that yield loss depends more on magnitude of severity of disease on flag leaf infection as compared to AUDPC based on whole plant leaf infection.

Effect of number of irrigations on yield, yield components and disease

In first year of experimentation, there was no significant effect of number of irrigation on non of the parameters recorded because there was frequent rain during experimentation period (Figure 2).

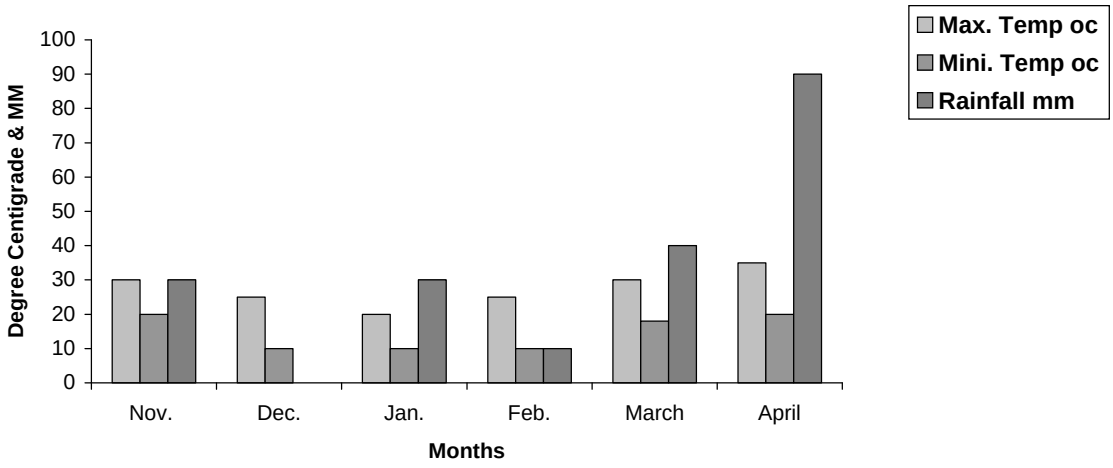

Figure 2. Mean whether parameters of experimental period, 2000-2003.

In second year of experimentation, AUDPC based on flag leaf infection was significantly less in case of Nepal-297. In third year, none of the parameters recorded were significantly affected by number of irrigations as there was rain during experimentation period. Sharma and Duveiller (2004) reported less yield reduction due to HLB in optimum soil moisture condition compared to less soil moisture condition.

Effect of doses of nitrogen fertilizer on yield, yield components and diseases

In the first year of experimentation, there was no significant effect of doses of nitrogen fertilizer on plant height, panicle length, thousand kernel weights and AUDPC based on whole plant. But AUDPC based on flag leaf infection, gain yield/plot, numbers of tillers/plant were significantly different. Number of tillers/plant, grain yield kg/plot were significantly more in higher dose of nitrogen, and disease AUDPC based on flag infection was less in higher dose of nitrogen (Table 1). Higher dose of nitrogen had significant effect in increasing plant height, panicle length and decreasing thousand kernel weight and AUDPC based on flag leaf infection (Table 2) in 2nd year of experimentation. Higher dose of nitrogen had highly significant effect in increasing plant height, number of tillers/plant, panicle length and grain yield/plot but had highly significant effect in lowering the AUDPC based on whole plant and flag leaf infection (Table 3, Figure 3).

Figure 3. Effect of doses of nitrogen fertilizer on AUDPC based on flag leaf infection in different years.

Ruckstuhul (1998) reported that low or imbalance soil nutrient levels predispose plants to more severe attack of leaf blight. Sharma and Duveiller (2004) also reported that higher value of AUDPC was found under low soil fertility condition compared to higher soil fertility condition. Our finding also indicated that low dose of nitrogen fertilizer had more disease as compared to higher dose of nitrogen. However, it is in conflict with finding of Singh et al (1998) who reported more disease with higher dose of nitrogen fertilizer.

Effect of dates of sowing of wheat on yield, yield components and disease

In first year of experimentation, first week of December sowing had highly significant effect on plant height, number of tillers/plant, thousand kernel weight, grain yield/plot, AUDPC based on whole plant as well as on flag leaf infection. These values were lower ion case of delay sowing of wheat. Disease was less when wheat was sown late but it also reduces the yield (Table 1). In second year of experimentation, late (1st week of Dec) wheat sowing had highly significant effect on plant height, panicle length, thousand kernel weight, grain yield/plot, terminal disease score and AUDPC based on flag leaf infection. All these parameters except plant height were less (Table 2).

Similar results were found from the third year experimentation (Table 3). There was significant effect of late sowing on AUDPC based on whole plant as well as flag leaf infection (Figure 4).

Figure 4. Effect of date of sowing on AUDPC based on whole plant & flag leaf infection in different years.

Singh et al (1998) reported low incidence of leaf blight when wheat was sown on 4th week of Nov. as compared to late sown of wheat. Our findings contradict with there. Our findings indicated that there was less AUDPC when crop was sown late (1st week of Dec) as compared to early sown (3rd week of Nov).

Form three years of experimental results, it can be concluded that Nepal-297 had relatively less area under disease progress curve, number of irrigations showed no significant effect on AUDPC as there was frequent rain during experiment period. Hundred kg of nitrogen application/hectare and late sowing (1st week of Dec) had resulted significantly less Area Under Disease Progress Curve values. Therefore to minimize the severity of leaf blight of wheat, wheat growers of this region should be advised to practice growing Nepal-297 or similar genotypes of wheat with application of relatively high dose of nitrogen fertilizer and late sowing. These will help in lowering the severity of leaf blight in eastern Tarai.

ACKNOWLEDGEMENT

The authors are very much thankful to Regional Directors, RARS, Tarahara for providing support in conducting the trial and also very much thankful to P Khatri and Balkumari Chhetri for their help in conducting the experiment.

REFERENCES

Bimb HP. 1979. Effect of DM-45 for control of leaf blight of wheat caused by *Helminthosporium spp.* **In:** *Annual Report 1978-1979*. National Wheat Research Program, Nepal Agricultural Research Council, Bhairahawa, Rupandehi, Nepal. Pp. 80-85.

Chaurasia PCP. 1997. Determination of a relationship between disease severity of leaf blight of wheat and grain yield loss. **In:** *Proceedings of Wheat Crops Research Paper Seminar* held at Wheat Research Program Bhairahawa, Sept. 7-10, 1975..

Duveiller E, I Garcia, J France, J Toledo, J Crossa and F. Lopez. 1998. Evaluating spot blotch resistance of wheat improving disease assessment under controlled condition and field. **In:** *Helminthosporium blights of wheat spot blotch and tan spot* (E Duveiller, HJ Dubin, J Reeves and A Mchab, eds). CIMMYT, Mexico, D.F.

Duveiller E. 2000. *Instruction sheet of 9th helminthosporium monitoring nursery 2000*. CIMMYT.

Karki CB and M Horsford. 1986. Epidemic of wheat blight in Nepal caused by *Pyrenophora tritici*- repentis. *Nepalese J. Agric.* 17-69-74.

Mahato BN and GP Sedhai. 1994. Loss assessment of wheat due to foliar blight. **In:** *Wheat Proceedings*. National Wheat Research Program, Nepal Agriculture Research Council, Bhiarahawa, Rupendehi, Nepal. Pp. 100-105.

NWRP 1996. Wheat disease report. **In:** *Annual Report 1995-1996*. National wheat Research Program (NWRP), Nepal Agricultural Research Council, Bhairahawa, Rupendehi, Nepal. Pp. 78-81.

NWRP 1977. Wheat disease report. **In:** *Annual Report 1976-1977*. National Wheat Research Program (NWRP), Nepal Agricultural Research Council, Bhairahawa, Rupandehi, Nepal. Pp. 70-80.

Ruckstuhl M. 1998. Population structure and epidemic of *Bipolaris sorakiniana* in rice-wheat cropping pattern in Nepal. **In:** *Helminthosporium blights of wheat spot blotch and tan spot* (E Duveiller, HJ Dubin, J Reeves and A Mchab, eds). CIMMYT, Mexico, D.F.

Shanner G and RE Finney. 1998. The effect of nitrogen fertilizer on the expression of slow mildwing resistancee in Knox wheat. *Phytopatholpgy* 67:1051-1056.

Sharma RC and E Duveiller. 2004. Effect of Helminthosporium leaf blight on performance of timely and late-seeded wheat under optimal and stresses levels of soil fertility and moisture. *Field Crop Research* 89:205-218.

Shrestha KK, RD Timla, BN Mahato and HB Bim 1998. Disease incidence and yield loss due to foliar blight of wheat in Nepal. **In:** *Helminthosporium blights of wheat spot blotch and tan spot* (E Duveiller, HJ Dubin, J Reeves and A Mchab, eds). CIMMYT, Mexico, D.F.

Singh RV, AK Singh, R Ahmad and SP Singh. 1998. Influencee of agronomic practices on foliar blight and identification of alternate hosts in the rice-wheat cropping systems. **In:** *Helmonthosporium blights of wheat spot blotch and tan spot* (E Duveiller, E, HJ Dubin, J Reeves and A Mchab, eds). CIMMYT, Mexico, D.F.