

Optimum Period of Propiconazole Spray for Integrated Management of Wheat Rusts and Karnal Bunt in Punjab

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ABSTRACT Tilt (Propiconazole), a triazole fungicide is applied as a single spray at heading stage to control Karnal bunt (Kb) disease of wheat in Punjab. The present study was undertaken to find out whether this application would also take care of the rusts, which have assumed alarming proportions in the recent past in the state. In order to standardize the appropriate time/stage of fungicidal spray (s) for the combined control of Kb and against stripe rust and leaf rust of wheat, eleven treatments comprising of single as well double sprays of recommended fungicide, Tilt including a check (unsprayed) were evaluated @ 0.1 per cent for three years (2004-2007) under Punjab conditions at different periods/stages (15th January to 22th March) of the crop. The plots receiving two sprays, respectively, first on 15th February and second on 8th or 22nd March exhibited the maximum disease control of Kb and rusts showing least area under disease progress curve (AUDPC) i.e 396.67 and 455.00, respectively, as compared to 1484.44 in check and maximum economic gains of Rs. 2762.26 and 2304.46/h. Even a single spray applied on 15th February was quite promising showing AUDPC of 734.44 and 89.93 per cent control of Kb with economical gains of Rs. 2042.92.

Key words: Stripe rust, leaf rust, Karnal bunt, management, Tilt.

In Punjab, there has been an alarming increase in the incidence of stripe rust (*Puccinia striiformis tritici* Westend) and leaf rust (*P. triticina* Bricks) of wheat (*Triticum aestivum* L.) during the last 4-5 years. In India 21.6 and 9.4m ha representing 80 and 35 per cent respectively of the total cultivated area is prone to leaf rust and stripe rust [1]. It has been estimated that even a 5 per cent reduction in wheat production can amount to Rs. 200,350m [2]. Comparatively, losses due to leaf rust are generally low (less than 10%) but could be higher (30% or more) under conducive conditions [3].

The wheat rusts can be managed by integrating management approaches (durable resistance, cultural practices and chemical control). However, new races of fungi render current sources of resistance obsolete and

fungicides are applied as an immediate measure when diseases suddenly flare up and are likely to result in epiphytotic. Tilt (Propiconazole), a triazole fungicide has already been recommended [4] for the management of Karnal bunt (Kb) caused by *Tilletia indica* (Mitra) and also found effective by other workers against rusts and other diseases in wheat [5, 6]. However, its time of application is very crucial as only a single or at the most two sprays are applied in view-of the economics of the spray as well as the ecological considerations [7].

Since the wheat crop in Punjab attains the heading stage between mid February to first week of March and application of Tilt for the management of Kb is recommended during this period, the present study, therefore, was conducted for three years (2004-2007) with an

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objective to find out the appropriate time of Tilt spray to have an effective and integrated control of Kb and rusts under Punjab conditions, to avoid its indiscriminate application by the farmers.

MATERIALS AND METHODS

The experiment was conducted under field conditions for three years (2004-2007) in randomized block design in three replications with a plot size of 6 x 2.5 m. A highly susceptible variety, WL 711 was used for experiments and artificial epiphytotics of rusts were created, using mixture of races (46 S 102, 46 S 119 and 78 S 84 for stripe rust and 77-2, 77-5, 104-2 and 12-2 for leaf rust) prevalent in North Western Plain Zone. Sowing was done on 11th November. Since stripe rust starts appearing around 15th January and leaf rust around second week of March, the efficacy of the recommended dose of Tilt @ 0.1 per cent was evaluated at different time intervals from 15th January to 22nd March either as a single spray (T1, T2, T3, T4) or double spray in all possible combinations of T1 to T4 and unsprayed served as check. Disease score of stripe and leaf rusts was recorded on 15th Jan, 15th February, 8th March and 22nd March following standard method using the modified Cobb's scale [8].

Area under disease progress curve (AUDPC) was calculated for stripe rust as follows:

$$A = \sum^{k-1} \frac{1}{2}(S_i + S_{i+1})d$$

where S_i = Initial Disease severity,

S_{i+1} = successive score of rust,

k = No. of successive evaluation of rusts,

d = interval of days between observations.

After harvesting, yield data were recorded on whole plot basis and finally converted into q/ha.

For the development of Kb, sporidia @ ~ 50,000 per ml of water were sprayed on 5th January, 5th & 15th February and 12th March so as to ensure availability of sporidial inoculum throughout the period of different spray treatments. After harvesting, average per cent

disease was calculated by counting infected and healthy grains in each year by randomly drawing a sample of 2000 grains from each treatment. The data in table 1 represent average infection for three years (2005-07).

The cost of the produce was calculated based on the procurement price of Rs. 615, 650 and 850 fixed for 2005, 2006 and 2007, respectively. The cost of one spray was worked out to be Rs. 650/ha by adding the cost of labour and price of the fungicide (100+550).

RESULTS AND DISCUSSION

The intensity of stripe rust in unsprayed plots was recorded from TS to 10S in the mid February which increased to 40S to 60S by the end of March during all the three years (Table 1). However, leaf rust did not appear up to first week of March and even in the last week its intensity was quite low (10S-20S). AUDPC for stripe rust was higher ranging 1376.67 to 1630 with an average of 1484.44 in the unsprayed plots (Table 2 & Fig. 1).

Rust intensity as well as AUDPC (Tables 1&2 and Fig. 1) was low in all the plots sprayed between 15th Feb. and second on 22nd March. The plots receiving two sprays, respectively, first on 15th Feb and second either on 8th March or 22nd March (T8 & T9) exhibited the maximum disease control showing least AUDPC i.e. 396.67 and 455.00, respectively, as compared to 1484.44 in check and maximum economic gains of Rs. 2762.26 and 2308.46/ha (Table 3). Both the treatments (T8 and T9) were statistically at par with each other. Even a single spray applied on 15th February was quite promising showing AUDPC of 734.44 and economical gains of Rs. 2042.92. The significance of appropriate time of spray has been highlighted by many workers from time to time [9-12].

Sprays carried out on 15th Feb and 8th March either as a single spray or in combination with other dates also provided high disease control of Kb ranging from 86.94 to 97.45 per cent.

Hence based on the above studies, the most appropriate time of single spray of tilt is mid February, however this can be complimented

Table 1. Stripe and leaf rust score after different intervals of spraying Tilt (0.1%)

Treatments - spray schedule	2004-05						2005-06						2006-07							
	Stripe rust		Leaf rust		Karnal bunt (%)		Stripe rust		Leaf rust		Karnal bunt (%)		Stripe rust		Leaf rust		Karnal bunt (%)			
	15/2	8/3	22/3	15/2	Inf.*	DC**	15/2	8/3	22/3	15/2	Inf.*	DC**	15/2	8/3	22/3	15/2	8/3	22/3	Inf.*	DC**
T1 15 th Jan	5S	40S-60S	40S-60S	10S-20S	15.36	2.35	5S-10S	40S-60S	40S-60S	10S-20S	18.40	14.10	5S-20S	60S-80S	60S-80S	10S-20S	60S-80S	10S-20S	13.17	9.97
T2 15 th Feb	TS-10S	10S-20S	20S-40S	5S-10S	1.60	89.93	TS-5S	20S-40S	20S-40S	TS-10S	1.80	91.60	5S-20S	20S-40S	40S-10S	5S-10S	40S-10S	5S-10S	1.43	90.23
T3 8 th Mar	TS-5S	40S-60S	20S-60S	TS-5S	2.03	87.79	TS-5S	20S-40S	40S-60S	5S-5S	2.81	86.93	TS-5S	40S-60S	60S-80S	TS-10S	60S-80S	TS-10S	1.96	86.61
T4 22 nd Mar	5S-10S	40S-60S	40S-60S	TS-5S	9.99	36.49	TS-5S	40S-60S	40S-60S	TS-5S	10.4	51.00	5S-10S	60S-80S	60S-80S	TS-5S	60S-80S	TS-5S	8.69	41.12
T5 T1+T2	5S-10S	10S-20S	10S-20S	5S-10S	1.73	89.77	5S-10S	10S-20S	20S-5S	1.73	89.77	5S-10S	10S-20S	20S-5S	20S-5S	TS-5S	40S-5S	TS-5S	1.42	90.23
T6 T1+T3	5S-10S	20S-40S	20S-40S	TS-5S	2.07	86.94	TS-5S	20S-40S	40S-5S	2.07	86.94	TS-5S	20S-40S	40S-5S	5S-10S	60S-80S	TS-5S	1.76	87.98	
T7 T1+T4	5S-10S	40S-60S	40S-60S	TS-5S	12.43	20.97	TS-5S	40S-60S	60S-5S	12.43	20.97	TS-5S	40S-60S	60S-5S	60S-80S	TS-5S	60S-80S	TS-5S	10.81	26.16
T8 T2+T3	TS-5S	5S-10S	5S-10S	5S-10S	0.40	97.45	5S-10S	10S-5S	10S-5S	0.40	97.45	5S-10S	10S-5S	10S-5S	10S-5S	20S-5S	20S-5S	TS-5S	0.22	98.50
T9 T2+T4	TS-5S	5S-10S	5S-10S	TS-5S	1.46	90.71	TS-5S	5S-10S	40S-5S	1.46	90.71	TS-5S	5S-10S	40S-5S	5S-10S	20S-5S	20S-5S	TS-5S	1.11	92.42
T10 T3+T4	TS-5S	10S-40S	20S-40S	TS-5S	1.93	87.73	TS-5S	20S-40S	40S-5S	1.93	87.73	TS-5S	20S-40S	40S-5S	60S-80S	60S-80S	TS-5S	60S-80S	1.65	88.73
T11 Check	TS-10S	40S-60S	60S-20S	10S-20S	15.73	-	TS-5S	40S-60S	60S-20S	15.73	-	TS-5S	40S-60S	60S-20S	60S-80S	10S-20S	10S-20S	14.64	-	-
CD (5%)					1.32					1.32									0.79	1.06

*Inf = Infection, **DC = Disease control

Table 2. Area under disease progress curve after different intervals of spraying Tilt (0.1%)

Treatments		2004-05	2005-06	2006-07	Mean (3 years)
T1	15 th January	1160.00	1233.33	1586.67	1326.67
T2	15 th Feb	656.67	583.33	963.33	734.44
T3	8 th March	1030.00	1015.67	1476.67	1174.44
T4	22 nd March	1283.33	1330.00	1616.67	1410.00
T5	T1+T2	586.67	433.33	673.33	564.44
T6	T1+T3	791.67	793.33	1366.67	983.89
T7	T1+T4	1125.00	1195.67	1516.67	1279.44
T8	T2+T3	343.33	296.67	550.00	396.67
T9	T2+T4	433.33	330.00	601.67	455.00
T10	T3+T4	866.67	820.00	1376.67	1021.11
T11	Check	1446.67	1376.67	1630.00	1484.44
CD (0.05)		49.18	330.73	217.62	220.87

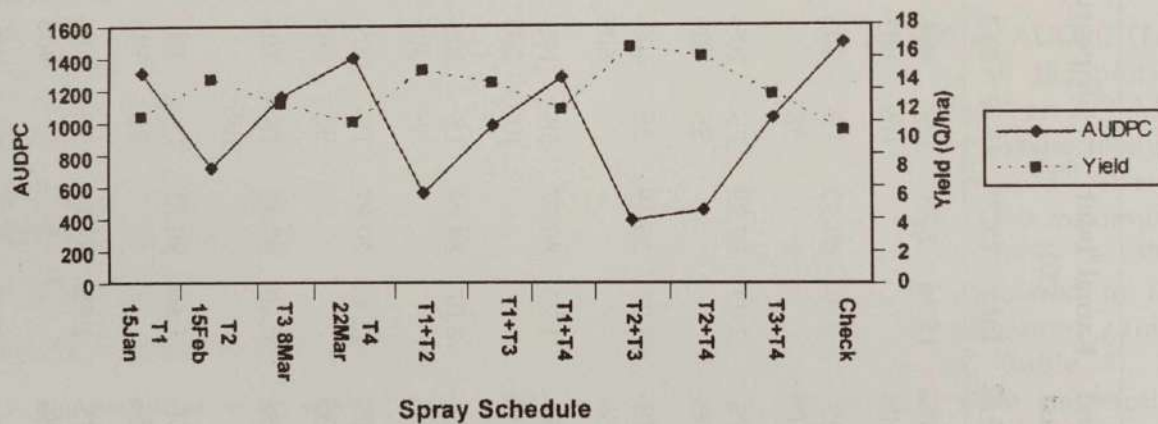


Fig. 1. Effect of Tilt (0.1%) spraying on area under disease progress curve (AUDPC) and yield

with another spray in the first week of March if intensity of rusts remain high and weather factors become conducive for the occurrence of Kb.

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Table 3. Effect of spraying Tilt (0.1%) at different intervals on wheat yield

Treatments	2004-05				2005-06				2006-07				Pooled data of 3 years			
	Yield (Q/ha)	Increase in yield over check	Net gain (+)/loss (Rs.)	Yield (Q/ha)	Increase in yield over check	Net gain (+)/loss (Rs.)	Yield (Q/ha)	Increase in yield over check	Net gain (+)/loss (Rs.)	Yield (Q/ha)	Increase in yield over check	Net gain (+)/loss (Rs.)	Yield (Q/ha)	Increase in yield over check	Net gain (+)/loss (Rs.)	
																Q/ha
T1 15 th Jan	11.500	0.992	9.44	12.479	1.437	13.01	284.05	11.458	1.25	12.25	412.5	11.812	1.226	11.58	218.92	
T2 15 th Feb	13.585	3.077	29.28	15.521	4.479	47.65	2261.35	14.061	3.853	37.85	2625.05	14.389	3.803	35.92	2042.92	
T3 8 th Mar	12.625	2.117	20.15	13.500	2.458	22.26	947.7	11.875	1.667	16.42	766.95	12.666	2.08	19.65	792.2	
T4 22 nd Mar	11.013	0.505	4.80	11.875	0.833	7.54	-108.55	11.043	0.835	8.20	59.75	11.310	0.727	6.84	380.2	
T5 T1+T2	14.750	4.242	40.37	15.937	4.895	49.32	1881.75	14.270	4.062	39.93	2152.7	14.986	4.40	41.56	1781.07	
T6 T1+T3	13.277	2.769	26.35	14.896	3.854	34.90	1204.45	13.645	3.437	33.81	1621.45	13.939	3.35	31.67	1076.28	
T7 T1+T4	11.983	1.475	14.03	12.666	1.624	14.98	-244.4	11.666	1.458	14.33	-60.7	12.105	1.52	14.36	-232.66	
T8 T2+T3	15.803	5.29	50.39	17.566	6.524	58.98	2940.6	15.729	5.521	54.14	3392.85	16.366	5.78	54.60	2762.26	
T9 T2+T4	14.867	4.356	41.48	16.792	5.75	52.07	2437.5	15.395	5.187	50.10	3108.95	15.685	5.10	48.17	2308.46	
T10 T3+T4	12.917	2.409	22.92	13.854	2.812	25.46	527.8	12.604	2.396	23.52	736.6	13.125	2.54	23.98	484.31	
T11 Check (Untreated)	10.508	-	-	11.042	-	-	-	10.208	-	-	-	10.586	-	-	-	
CD (0.05)	0.453	-	-	1.101	-	-	-	1.725	-	-	-	1.160	-	-	-	

The expenditure on cost of fungicides and labour is calculated @ Rs. 650/- per spray.

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