



FIELD EFFICACY OF DIFFERENT FUNGICIDES FOR THE CONTROL OF BROWN RUST OF SUGARCANE IN WESTERN MAHARASHTRA

S. V. Nalawade¹, D. V. Indi², D. R. Murumkar³ and S. M. Pawar¹

¹Central Sugarcane Research Station, Padegaon

²National Agricultural Research Project, Zonal Agricultural Research Station, Solapur

³AICRP on Safflower, Zonal Agricultural Research Station, Solapur

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Abstract: Seven fungicides were tested against brown rust disease of sugarcane under natural field conditions during three consecutive *Suru* seasons from 2012-13 to 2014-15. All the seven fungicides had a significant influence on the rust intensity, cane yield, CCS yield and sucrose content in cane juice. Among different fungicides, Tebuconazole 0.1% was found most effective for control of sugarcane rust as it recorded least rust intensity (7.75 %) and highest per cent disease control (86.4 %), cane yield (100.93 t ha⁻¹), CCS yield (14.65 t ha⁻¹) and the sucrose content (20.34 %) in cane juice. It was followed by Mancozeb 0.3 % which recorded the rust intensity (10.92%), per cent disease control (80.8%), cane yield (97.22 t ha⁻¹), CCS yield (13.95 t ha⁻¹) and the sucrose content (20.01 %) in cane juice. However, both these fungicides were at par with each other in respect of cane yield, CCS yield and the sucrose content in cane juice. The next fungicide in the order of effectiveness was Hexaconazole 0.1% which was at par with Tebuconazole 0.1 % in respect of cane yield.

Keywords: Sugarcane, *Saccharum officinarum* L., brown rust, *Puccinia melanocephala*.

Introduction

Brown rust caused by *Puccinia melanocephala* H. & P. Syd. was first reported on sugarcane in 1949 in the Deccan area in India (Patel *et al.*, 1950). The important leaf rust disease causes severe losses in sugarcane fields throughout the world (Magarey *et al.*, 2008). Sugarcane rust, once considered a minor pathogen in the Australian sugar industry, devastated most plantations of cv. Q124 in Australia causing yield losses up to 40 % (Apan *et al.*, 2003, Magarey *et al.*, 2008). In the USA, the yield loss caused by a rust epidemic in cv. CP 72-1210 in 1987 was 20 % (Raid and Comstock, 2000). The effect of rust disease on cane yield was evaluated by Raid and Comstock (2000) in field experiments conducted during three growing seasons. A combined analysis over three seasons showed that brown rust caused reductions of 16 % in cane yield and 14 % in total amount of sucrose produced in variety LCP 85-384. Hoy and Hollier (2009) reported that a mixture of three fungicides, azoxystrobin, propiconazole, and tebuconazole applied every two weeks during the

spring epidemic period kept brown rust severity low (<5%) and plants protected by fungicide applications throughout the epidemic provided an estimate of attainable yield for comparison with plants naturally infected with rust. The greatest reduction in total sucrose yield of 22% resulted from the epidemic of longest duration and stalk weight was negatively correlated with rust severity. The incidence of brown rust is increasing in Western Maharashtra from the last decade. Hence, the present investigation was planned to find out effective fungicide/s for the management of brown rust on sugarcane in Western Maharashtra.

Materials and Methods

A field experiment was conducted during *Suru* season (January planting) of 2012-13, 2013-14 and 2014-15 in a randomized block design with four replications to study the effect of different fungicides on the intensity of rust disease on sugarcane variety Co VSI 9805 so as to find out effective chemical for management of sugarcane rust. The plot size employed was 6.0x6.0m (5 Rows of 6m). The crop

was applied with fertilizers as per the recommended dose for the *Suru* crop i.e. 250:115:115 Kg N, P₂O₅ and K₂O/ha. The fertilizer doses were applied in four splits; nitrogen was applied @ 10 % at planting, 40 % at 6 weeks, 10 % at 14 weeks and 40 % at 18

weeks whereas 50 % each of P₂O₅ and K₂O were applied at planting and remaining 50 % were applied at 18 weeks. The fungicides, their formulations and the actual spray concentrations used are given as under.

Treat. No.	Fungicide a.i.	Spray conc. (%)
T ₁	Chlorothalonil 75 WP	0.25
T ₂	Propineb 70 WP	0.20
T ₃	Triadimefon 25 WP	0.10
T ₄	Mancozeb 75 WP	0.30
T ₅	Tebuconazole 25 SC	0.10
T ₆	Hexaconazole 5 EC	0.10
T ₇	Propiconazole 25 EC	0.10
T ₈	Water sprayed control	

The first spray was applied immediately after disease appearance and the subsequent two sprays were applied at 15 days interval. The intensity of rust was recorded after 15 days of the last spray on the basis of area covered on top, bottom and upper leaves of ten randomly selected clumps. The cane yield was recorded after harvest and the juice quality parameters like commercial cane sugar content (CCS %), CCS yield and sucrose content in cane juice were determined. The data obtained were subjected statistical analysis by employing standard methods for analysis of variance (Panse and Sukhatme, 1985).

Results and Discussion

The pooled data on intensity of rust disease, cane yield, CCS yield and sucrose content in cane juice as influenced by different fungicidal treatments are presented in Table 1 and Table 2. All the fungicides had a significant influence on the rust intensity, cane yield, CCS yield and sucrose content in cane juice. Among different fungicides, Tebuconazole 0.1% recorded significantly least rust intensity (7.75 %) and highest per cent disease control (86.4 %). As regards cane yield, Tebuconazole 0.1% recorded highest cane yield (100.93 t/ha), however, it was at par with Mancozeb 0.3% (97.22 t/ha) and Hexaconazole (95.83 t/ha). Moreover in respect of quality parameters, Tebuconazole 0.1% recorded highest CCS% (14.53%), CCS yield (14.65 t/ha) and sucrose content (20.34%), however, it was at par with Mancozeb 0.3%

in respect of CCS% (14.35%), CCS yield (13.95 t/ha) and sucrose content (20.01%). Hoy and Hollier (2009) reported that Azoxystrobin, Propiconazole and Tebuconazole applied every two weeks during the spring epidemic period kept brown rust severity low (<5%) and plants protected by fungicide applications throughout the epidemic provided an estimate of attainable yield in comparison with plants naturally infected with rust.

The economics of management of sugarcane rust as influenced by different fungicide treatments is depicted in Table 3. The cost-benefit analysis of different fungicidal treatments showed that Tebuconazole 25 SC treatment recorded highest C:B ratio (2.09) followed by Mancozeb 75 WP (2.02).

Conclusion

The overall results indicated that three sprays of Tebuconazole @ 0.1 % was found most effective and economical for management of sugarcane rust in Western Maharashtra closely followed by Mancozeb @ 0.3%.

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Table 1: Effect of different fungicides on intensity of rust disease and cane yield of sugarcane (Pooled: 2012-13, 2013-14 and 2014-15)

Treatments	Conc.	Disease Intensity (%)*			Pooled Mean	% disease control	Cane yield (t/ha)			Pooled Mean	% increase in yield over control
		2012-13	2013-14	2014-15			2012-13	2013-14	2014-15		
T ₁ Chlorothalonil 75 WP	0.25 %	10.75 (19.12)	15.50 (23.15)	20.50 (26.90)	15.58 (23.06)	72.7	89.98	97.92	88.79	92.23	11.09
T ₂ Propineb 70 WP	0.20 %	11.00 (19.34)	17.25 (24.50)	22.25 (28.11)	16.83 (23.99)	70.5	87.64	95.97	86.30	89.97	8.37
T ₃ Tridemefon 25 WP	0.10 %	15.50 (23.16)	22.25 (28.12)	27.25 (31.44)	21.67 (27.57)	62.0	86.70	95.83	86.08	89.54	7.85
T ₄ Mancozeb 75 WP	0.30 %	7.75 (16.14)	11.25 (19.47)	13.75 (21.71)	10.92 (19.11)	80.8	93.52	100.56	97.59	97.22	17.10
T ₅ Tebuconazole 25 SC	0.10 %	5.75 (13.84)	7.25 (15.48)	10.25 (18.59)	7.75 (15.97)	86.4	99.80	101.25	101.73	100.93	21.57
T ₆ Hexaconazole 5 EC	0.10 %	10.25 (18.65)	12.25 (20.36)	17.25 (24.46)	13.25 (21.16)	76.8	92.04	99.65	95.79	95.83	15.43
T ₇ Propiconazole 25 EC	0.10 %	15.75 (23.37)	24.00 (29.31)	29.00 (32.56)	22.92 (28.42)	59.8	85.14	93.47	86.01	88.21	6.25
T ₈ Water sprayed control	--	42.50 (40.66)	59.25 (50.32)	69.25 (56.32)	57.00 (49.10)		82.39	85.76	80.89	83.02	
SE±		0.61	1.05	0.90	0.50		3.87	2.71	4.70	2.22	
CD at 5 %		1.80	3.09	2.64	1.42		11.38	7.97	13.81	6.27	
C.V. %		5.60	7.99	5.99	6.70		8.64	5.63	10.39	8.35	

* Figures in parentheses are the arc-sines to which the statistical analysis pertains.

Table 2: Effect of different fungicides on quality parameters of sugarcane (Pooled: 2012-13, 2013-14 & 2014-15)

Treatments	Conc.	CCS %			Pooled Mean	CCS yield (t/ha)	Sucrose %			Pooled Mean
		2012-13	2013-14	2014-15			2012-13	2013-14	2014-15	
T ₁ Chlorothalonil 75 WP	0.25 %	14.06	14.23	12.22	14.01	12.94	20.53	19.93	19.56	20.00
T ₂ Propineb 70 WP	0.20 %	13.95	14.23	11.85	13.96	12.58	20.05	19.89	19.16	19.70
T ₃ Tridemefon 25 WP	0.10 %	13.92	14.20	11.79	13.94	12.49	20.34	19.68	18.36	19.46
T ₄ Mancozeb 75 WP	0.30 %	14.63	14.38	13.70	14.35	13.95	20.95	19.92	19.16	20.01
T ₅ Tebuconazole 25 SC	0.10 %	14.86	14.46	14.47	14.53	14.65	21.17	20.12	19.75	20.34
T ₆ Hexaconazole 5 EC	0.10 %	14.10	14.24	13.34	14.08	13.49	19.95	19.86	19.05	19.62
T ₇ Propiconazole 25 EC	0.10 %	13.57	14.17	11.28	13.59	12.02	19.35	19.83	18.57	19.25
T ₈ Water sprayed control	--	12.90	14.08	10.34	13.26	11.02	18.75	19.68	17.94	18.79

SE±		0.27	0.13	0.70	0.13	0.34	0.32	0.15	0.27	0.15
CD at 5 %		0.79	NS	2.10	0.36	0.95	0.93	NS	0.79	0.42
C.V. %		3.83	1.83	11.54	3.20	9.02	3.15	1.50	2.84	2.60

whereas, CCS = Commercial cane sugar

Table 3: Economics of management of sugarcane rust as influenced by different fungicide treatments (Pooled: 2012-13, 2013-14 and 2014-15)

Tr. No.	Treatments	Conc. (%)	Cane yield (t/ha)	Gross returns (Rs/ha)	Additional returns (Rs/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)	C:B ratio
T ₁	Chlorothalonil 75 WP	0.25	92.23	207518	20723	109332	98185	1.90
T ₂	Propineb 70 WP	0.20	89.97	202433	15638	108521	93911	1.87
T ₃	Tridemefon 25 WP	0.10	89.54	201465	14670	109637	91828	1.84
T ₄	Mancozeb 75 WP	0.30	97.22	218745	31950	108469	110276	2.02
T ₅	Tebuconazole 25 SC	0.10	100.93	227093	40298	108631	118461	2.09
T ₆	Hexaconazole 5 EC	0.10	95.83	215618	28823	108567	107050	1.99
T ₇	Propiconazole 25 EC	0.10	88.21	198473	11678	109387	89085	1.81
T ₈	Water sprayed control	--	83.02	186795		107887	78908	1.73

Market rates: 1) Sugarcane- Rs. 2250/t 2) Chlorothalonil - Rs. 1156/kg
 3) Propineb- Rs.634/kg 4) Tridemefon- Rs.3500/lit.
 5) Mancozeb - Rs.388/kg 6) Tebuconazole - Rs. 744/lit.
 7) Hexaconazole-Rs.680/lit. 8) Propiconazole - Rs. 1500/lit.