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INTEGRATED MANAGEMENT OF SOYBEANRUST

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ABSTRACT

The rust disease of soybean caused by the fungal pathogen which named *Phakopsora pachyrhizi(Sydo*w) could cause soybean rust, was the most destructive pathogen and caused soybean yield declined by 20-80%. In the present investigation, a botanical fungicide, neem seed kernal extract along with hexaconazole, propiconazole and triadimefon had reduced the disease severity of rust disease. Three sprays of hexaconazole alone have considerably reduced disease severity to higher level (9.54%) and resulted in significantly higher seed yield (24.79q/ha), 100 seed weight (14.37), lesser Area Under Disease Progress Curve (AUDPC) (339.03) and highest B: C (7.07:1) ratio. The nimbicidine in the spraying schedule with other fungicides was found to be effective in reducing percent disease index and area under disease progress curve. Though the yield in treatment (H-H-H) was highest (24.79 q/ha) compared to H-N-H (19.82q/ha) and P-N-P (19.41q/ha) the quality traits like protein and oil contents were on par with each other. The B: C ratio of 3.85:1 in H-N-H indicated that the inclusion of nimbicidine in the spray schedule is more useful not only in reducing the cost of protection but also gave higher benefits in addition to giving insurance against resistance development by the fungus against hexaconazole.

Key words*:* Soybean, rust, integrated management

1. INTRODUCTION

In recent years, soybean rust caused by Phakopsora pachyrhizi (sydow), has become one of the major diseases which was known to occur in Korea, Japan, Australia, China and India [1]. It occurs in all parts of the world, wherever soybean is cultivated. The disease is most severe under assured rainfall/irrigated conditions with moderate temperature and extended leaf wetness [2]. Rust in karnataka, India was severe and caused losses up to 20-80 % in JS-335 the most commonly cultivated variety in northern Karnataka [4]. The disease is reported to cause 20-80, 50-70, 30-100 % yield loss in karnataka, Maharashtra, Madhyapradesh and Tamil nadu respectively [7]. A single method of control may not completely manage the disease effectively, it is necessary to develop an integrated management strategy having host plant resistance, plant extracts and fungicides as components of integrated disease management.

MATERIALS AND METHODS

A field trial on integrated disease management was carried out at research and development farm of Ugar-Sugar works Ltd., ugarkhurd under irrigated conditions to know the efficacy of three triazole fungicides viz, hexaconazole (H), propiconazole (P) and triadimefon (T) and a botanical pesticide nimbicidine (N) against soybean rust pathogen Phakopsora pachyrhizi. In each replication one control plot without

fungicidal application was maintained. The chemicals were measured accurately just before spraying and mixed thoroughly with water. The details of treatment combinations and fungi toxicants are listed in Table1 and Table 2

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Table : 1 ***Details of different fungi toxicants used in the treatment***

Sl. No.	Common name	Chemical name	Trade name
1	Hexaconazole	5% EC (Contaf 5E) 2-(2,4 dichlorophenyl)-1-(1H, 1,2,4- triazole-1-yl hexan -2-01	Contaf
2	Propiconazole	25% EC(tilt 25 EC, 1-2,4 dichlorophenyl)-4-propyl 1, 3-dioxolan-2-methyl)-H-1, 4-triazole)	Tilt
3	Triadimefon	25% WP (Bayleton 25 WP, (1-(4-chlorophenoxy) - 3, 3dimethyl-1-H) (1, 2,4 triazole –l-y-l)-2-butanone	Bayleton
4	Nimbicidine	A neem kernel based fungicide	Nimbicidine

Table : 2 ***Details of treatment combination and concentration***

Sl. No.	Treatment	Concentration (%)
1	H-N-H	0.1%-0.5%-0.1%
2	P-N-P	0.1%-0.5%-0.1%
3	T-N-T	0.1%-0.5%-0.1%
4	N-H-N	0.5%-0.1%-0.5%
5	N-P-N	0.5%-0.1%-0.5%
6	N-T-N	0.5%-0.1%-0.5%
7	H-H-H	0.1%-0.1%-0.1%
8	P-P-P	0.1%-0.1%-0.1%
9	T-T-T	0.1%-0.1%-0.1%
10	N-N-N	0.5%-0.5%-0.5%
11	Control (without fungicides)	--------

Design and layout

Design: Random Block Design (RBD)
Plot size: 1.8X 4.0 sq mt
Spacing: 60X 30 cms
Variety: JS-335
Spray schedule: monthly interval

RESULTS

All the treatments were significantly superior to untreated control (T11) after every spray (Table 1). After first application of the fungicide the treatments T7 (H-H-H), T8 (P-P-P), T9 (T-T-T), T1(H-N-H), T2 (P-N-P) and T3 (T-N-T) did not differ significantly with each other where in the PDI ranged between 29.54 to 35.53. The PDI in T4 (N-H-N), T5 (N-P-N), T6 (N-T-N) and T10 (N-N-N) were found on par with each other with the PDI ranging between 45.28 to 48.18. The soybean plots which received nimbicidine with chemical fungicides T1 (H-N-H), T2 (P-N-P) and T3 (T-N-T) were on par and the PDI ranged from 26.29 to 27.37. However they were significantly inferior to T7, T8 and T9.

The treatments where in chemical fungicides were sprayed after the botanicals (T4, T5 and T6) recorded less PDI than in T10. After third application T7 recorded least PDI of 9.54 which is considerably superior over all other treatment combinations.

As far as mean PDI is concerned lowest was recorded inT7 (17.74) followed by T8 (22.42) and T9 (21.21). Combinations of chemical fungicides with botanical (T1,T2 and T3) recorded mean PDI ranging from 26.29 to 27.37 . Treatment T10 recorded mean PDI of 40.77. In T4, T5 and T6 mean PDI of 36.09, 36.81 and 32.69 was

recorded. The highest PDR of 74.52 was recorded in T7 followed by T8 (67.81) and T9 (66.67), where as PDR range of 45.89 to 62.25 was recorded in T1 to T6 and least PDR was recorded in T10 (45.28).

Soybean seed yield differed significantly among the treatmentsT1 to T10 where in the untreated control (T11) recorded minimum yield, while the plots which received 3 sprays of hexaconazole (T7) produced maximum yield which was to the extent of 11.59 q/ha and 24.79 q/ha, respectively. The treatments T8, T9 did not differ among themselves and were significantly superior to rest of the treatments except T7. The soybean plots which received continuously three sprays of nimbicidine (T10) and two sprays of nimbicidine with chemical fungicide od (T4, T5 and T6) produced significantly less yield than other treatments except T11 (control).

Hundred seed weight revealed that the maximum 100 seed weight was recorded in the plots receiving 3 sprays of hexaconazole (T7). However the plots receiving chemical fungicide with nimbicidine (T1) and the plots receiving 3 sprays of propiconazole (T8) were next best treatments and on par with each other.

The least AUDPC was recorded in T7 (339.03) from among the only chemical fungicide sprayed plot. However, among the nimbicidine used in combination plots T1 recorded least AUDPC compared to T11 (1176.81). The highest cost benefit of 7.07 was observed in T7 followed by 3.85 in T1.

TABLE: 3

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Sl. No	Treatment	Percent disease index (PDI)				Percent disease reduction over control	Yield q/ha	Hundred grain weight (g)	Benefit Cost ratio	AUDPC	Protein content (%)	Oil content (%)
		I	II	III	Mean							
1	H-N-H	35.53 (34.14)*	26.33 (30.88)	20.87 (27.14)	26.29	62.25	19.82	13.39	3.85:1	479.10	36.27	19.00
2	P-N-P	32.24 (34.63)	27.15 (31.39)	21.39 (27.51)	27.01	61.22	19.41	12.67	2.44:1	492.21	35.46	18.92
3	T-N-T	32.35 (34.66)	27.74 (31.75)	22.76 (28.42)	27.37	60.71	19.19	11.92	1.53:1	497.60	36.30	18.62
4	N-H-N	45.49 (42.36)	33.74 (35.52)	28.73 (32.44)	36.09	48.18	16.71	12.12	1.22:1	656.25	34.85	18.02
5	N-P-N	46.51 (42.99)	34.22 (35.79)	28.95 (32.94)	36.81	47.15	16.45	11.84	1.65: 1	669.28	33.50	18.72
6	N-T-N	47.34 (43.45)	35.11 (36.35)	30.30 (33.40)	32.69	45.89	16.24	11.78	1.22:1	684.86	34.71	18.64
7	H-H-H	29.54 (32.92)	13.96 (21.88)	9.54 (17.92)	17.74	74.52	24.79	14.37	7.07: 1	339.03	37.65	19.34
8	P-P-P	32.07 (34.47)	20.28 (26.71)	14.74 (22.56)	22.42	67.81	22.39	13.18	3.12:1	419.27	35.39	19.38
9	T-T-T	32.83 (34.94)	20.72 (27.06)	15.84 (23.39)	21.21	66.67	22.24	12.46	1.74:1	431.85	36.83	18.52
10	N-N-N	48.42 (44.08)	43.85 (41.43)	39.26 (38.74)	40.77	45.28	13.91	10.93	0.87:1	782.08	35.80	18.61
11	Control (without fungicides)	59.05 (50.16)	68.32 (55.70)	81.64 (64.61)	69.65	---	11.59	9.66	---	1176.81	33.33	18.42
	S.Em	0.99	0.63	0.87			0.48	0.52			0.502	0.526
	C.D. @ 5 %	2.80	1.80	2.47			1.39	1.48			1.425	NS

Figures in parenthesis are arc sine transformed.

DISCUSSION

In the present investigation, nimbicidine along with hexaconazole, propiconazole and triadimefon have reduced the disease severity of rust up to 85 DAS. Three consecutive sprays of hexaconazole alone have considerably reduced the disease severity to higher level. Thus resulted in getting significantly higher seed yield, 100 seed weight, lesser AUDPC and highest B:C ratio. These findings are in confirmation [5] who revealed that two sprays of hexaconazole @ 0.05% at 15 days interval gave best result among other fungicides tested in controlling the disease followed by triadimefon (0.01%), propiconazole (0.1%). He also opined that maximum 100 seed weight was obtained from triadimefon treatment followed by hexaconazole and propiconazole.

Two sprays of hexaconazole (0.1%) at 15 days interval starting from the initiation of the disease have significantly reduced the rust and increased the grain yield by 75-85 % and 85-135 % respectively followed by propiconazole and triadimefon [6].

The addition of nimbicidine in the spraying schedule along with hexaconazole, propiconazole and triadimefon was found to be effective in reducing values of PDI and AUDPC at all stages of the crop growth [7]. The spray combination of H-N-H reduced one spray of hexaconazole thus increasing benefit cost ratio as well as gave insurance against development of resistance to fungicides. Though the seed yield in treatment H-H-H was highest (24.79q/ha) compared to H-N-H and P-N-P treatment but the quality traits like protein and oil contents were on par with each other. These results are in agreement [6,9].

The present investigation revealed that maximum B: C of 7.07:1was realized in 3 sprays of hexaconazole (0.1%) followed by 3.85:1(H-N-H). This clearly indicated that the inclusion of nimbicidine in the middle of spary schedule is more useful not only reducing the cost of protection but also gave higher benefits as compared to nimbicidine included either in propiconazole or triadimefon and control in addition to giving insurance against resistanace development by the fungus against hexaconazole. The fungicidal property in the neem plant part is due to terpenoid substances. More than 50 terpenoid substances have been isolated from neem tree [3]. Hence spraying of hexaconazole (0.1%) at 30 and 60 days after sowing and nimbicidine (0.5%) at 45 days after sowing could be considerd as an effective management practice for the soybean rust.

CONCLUSION

The treatment combination H-N-H spray schedule under less disease pressure and H-H-H spray schedule under high disease pressure may be useful to achieve higher yields.

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