Research Paper :

Management of Asian soybean rust incited by *Phakopsora pachyrhizi* Sydow by indigenous technology knowledge in India

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SUMMARY

The Asian soybean rust, *Phakopsora pachyrhizi* Sydow is the economically important disease, which causes significant yield loss in India. The present study comprised of thirteen different treatments taken up at MARS, UAS, Dharwad during *Kharif,* 2008 and 2009. The treatments were applied thrice with first one immediately after appearance of rust symptoms in the field and subsequently at 10 days interval. Thirteen different treatments comprising of botanicals, bioagents and micronutrients were evaluated against soybean rust. The pooled analysis over two years revealed that among the ITK measures, application of cow urine@10%+*Pongamia pinnata* oil@0.5% recorded minimum Per cent Disease Index (PDI) of 37.9 followed by cow urine@10% alone (40.24). The maximum seed yield of 10.10 q/ha was recorded in seed treatment with cow urine 10%+*Prosopis juliflora*@5% followed by spraying with cow urine@10% potasium phosphonate @3% (10.04q/ha).The positive check recorded minimum disease pressure (24.75 PDI) and maximum seed yield of 11.02q/ha.However,the highest disease pressure was in untreated check (77.3 PDI) with seed yield of 7.65q/ha. The elicitors like *Pongamia pinnata* oil, potasium phosphonate,$MnSO_4$,*Adathoda vessica* along with cow urine be used in developing Integrated Disease Management strategies against Asian soybean rust in India which will help in reducing the chemical pesticides in long term sustainable management. The present findings drawn the first line of research on utilization of Indigenous Technology Knowledge in managing rust and enhancing both yield and quality parameters of soybean in India.

Key words : Indigenous Technology Knowledge, Management, *Phakopsora pachyrhizi*

The Asian soybean rust is the economically important disease not only in the Sub continent but also rest of the soybean growing regions of the world. The predominantly associated pathogen, *Phakopsora pachyrhizi* Sydow, has been known to drastically reduce yields in Asia. In areas where the pathogen occurs in most virulent form yield losses up to 80% have been reported. Basically the pathogen was confined to eastern hemisphere before it had appeared in epiphytotic form in Hawaii region in 1994. At present, the pathogen has been reported from different continents such as Africa, Asia, Australia, South America and Hawaii. The rapid spread of *P. pachyrhizi* and potential for severe yield losses makes this, the most destructive foliar disease of soybean. Soybean rust could have a major impact on both total soybean production and production costs in the India. In India, the disease was first reported on soybean in 1951 (Sharma and Mehta, 1996).Two *Phakopsora* species are known to cause soybean rust (Ono *et al.*, 1992).The more aggressive species is *P. pachyrhizi,* known as the Asian soybean rust. *Phakopsora meibomiae*, the less virulent species, has only been found limited areas in the Western hemisphere, and it is not known to cause severe yield losses in soybean.

Most research on control has been focused on the use of fungicides and host plant resistance. Some cultural practices have been recommended that minimize the impact of rust (Desborough,1984, Hartman *et al.*, 1992).The recommendations differed, but were based upon avoiding the conditions that promote disease development or were practices that optimized overall yields. Research on biological control has been limited in the management of soybean rust. In recent years, the studies on use of Indigenous Technology Knowledge (ITK) measures in the managing the crop diseases have been demonstrated successfully in crops like sorghum, tomato, banana and black pepper (Shamarao Jahagirdar, 1998: Shamarao Jahagirdar *et al.*, 2000: Shamarao Jahagirdar

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et al., 2008).The soybean growers of the subcontinent are seriously facing the severe infestation of rust disease in the last few years with a yield loss ranging from 30-100%.There are no resistant cultivars at present for Asian soybean rust and continuous application of fungicides has further aggravated the concern over pesticide resistance. Keeping these points in view, the investigation comprised of screening of Indigenous Technology Knowledge (ITK) measures against Asian soybean rust in India and with an aim of enhancing the productivity in terms of both quality and quantity soybean yields in India.

MATERIALS AND METHODS

The present study comprised of thirteen different treatments taken up at Main Agricultural Research Station (MARS), University of Agricultural Sciences (UAS), Dharwad during *Kharif* 2008 and 2009. The treatments were applied thrice with first one immediately after appearance of rust symptoms in the field and subsequently at 10 days interval. Thirteen different treatments comprising of botanicals, bioagents and micronutrients were evaluated against soybean rust. The botanicals and cow urine were applied thrice starting from disease appearance and subsequently at 10 days interval.

The details of the experimentation comprised of 13 treatments with most susceptible cultivar JS 335 replicated three times with a plot size of 2.7x4.0mt.The sowing was taken up on 22-07-2008 and 6-7-2009.The different treatments were applied on 04-09-2008, 15-09-2008 and 01-10-2008 during 2008 and 18-9-2009,25-9-2009, 2-10-2009 during 2009.The seasonal conditions revealed late on set of monsoon in the region. The total rainfall received was 926.8mm spread over 60rainy days in 2008. In 2009, total rainfall received was 1022.6mm spread over 66 rainy days. The receipt of above normal rainfall during August and September months coupled with high relative humidity and intermittent rainfall resulted in epiphytotics of rust during the season. Hence, the season was more congenial for development of strategies for rust management. Observations on rust severity were recorded by usual manner when the crop was 85 days old. For scoring the intensity of rust, ten plants were randomly selected in the central rows of the plots. The per cent disease index (PDI) was further calculated and seed yield was also recorded at harvest (q/ha).The data were statistically analysed as per Sukhatme and Amble (1985).

RESULTS AND DISCUSSION

The research results on effectiveness of biorationals and ITK measures are presented in Table 1. The results indicated during 2008, the minimum per cent disease index was recorded in Hexaconazole @1ml/l(17.29) which differed significantly from rest of the treatments. Among the ITK measures application of cow urine @ 10% + *Pongamia pinnata* oil@0.5% recorded minimum Per cent Disease Index (PDI) of 32.10 followed by cow urine @ 10% alone (34.57).Among ITK measures,the treatments cow urine @ 10% + $MnSO_4$ @ 0.3%, cow urine @ 10% + Multik @ 0.5%, cow urine @ 10% + *Adathoda vessica* @ 5% and cow urine @ 10% alone were stastically on par with each other. The maximum seed yield of 9.70q/ha was recorded in Hexaconazole@0.1% followed by Cow urine @10%+ Potassium Phosphonate @ 0.3% (8.97q/ha). The highest disease pressure was in untreated check (67.89 PDI) with seed yield of 6.78q/ha. During 2009, among the ITK measures, minimum disease pressure was recorded in seed treatment with cow urine @ 10% + *Prosopis juliflora* @ 5% @10%(39.6 PDI) followed by spray with neem oil alone @ 1(40.6PDI). However,there was no significant difference with respect to disease severity among different ITK measures. Maximum seed yield of 11.82q/ha was recorded in seed treatment with cow urine @ 10% + *Prosopis juliflora* @ 5% followed by 11.64q/ha in cow urine@10% alone. The positive check, hexaconazole @0.1% recorded disease pressure of 32.2PDI and seed yield of 12.33q/ha. The maximum disease pressure was in control(86.7 PDI) with a seed yield of 8.52 q/ha. The pooled analysis over two years revealed that among the ITK measures, application of cow urine @10% +*Pongamia pinnata* oil@0.5% recorded minimum Per cent Disease Index (PDI) of 37.9 followed by cow urine@10% alone (40.24). The maximum seed yield of 10.10 q/ha was recorded in seed treatment with cow urine 10%+Prosopis juliflora@5% followed by spraying with cow urine@10% Potasium phosphonate @3% (10.04q/ha).The positive check recorded minimum disease pressure (24.75 PDI) and maximum seed yield of 11.02q/ha.However,the highest disease pressure was in untreated check (77.3 PDI) with seed yield of 7.65q/ha.The study over two years clearly indicated superiority of all the ITK measures in checking soybean rust and there was no significant difference with respect to disease pressure. Cow urine @ 10% + *Prosopis juliflora* @ 5% and cow urine @ 10% + Pot phosphonate @ 0.3 % differed significantly over other ITK measures with regard to seed yield.

In the present investigation, use of chemical elicitors like Multi K and MnSo4, plant based extracts like *Adathoda vesica*,*Prospopis juliflora*,*Pongamia pinnata* oil, neem oil, Cristol and bioagent *Trichoderma harzianum* in combination with cow urine triggered the

Table 1 : Integrated management of soybean rust through indigenous technology knowledge in India

Sr. No.	Treatments	PDI			Seed yield(q/ha)		
		2008	2009	Mean	2008	2009	Mean
1.	Cow urine @ 10% + $MnSO_4$ @ 0.3%	38.27 (38.2)	44.4 (41.8)*	41.34 (39.99)	6.43	9.94	8.19
2.	Cow urine @ 10% + Multik @ 0.5%	35.80 (36.7)	45.9 (42.6)	40.85 (39.70)	7.14	9.97	8.56
3.	Cow urine @ 10% + *Adathoda vessica* @ 5%	38.27 (38.2)	45.5 (42.4)	41.89 (40.28)	7.84	10.84	9.34
4.	Cow urine @ 10% + *Prosopis juliflora* @ 5%	45.68 (42.5)	39.6 (39.0)	42.64 (40.74)	8.38	11.82	10.10
5.	Cow urine @ 10% + Neem oil @ 0.5%	40.74 (39.6)	45.5 (42.4)	43.12 (41.03)	8.45	10.46	9.46
6.	Cow urine @ 10% + *Trichoderma* sp. @ 0.5%	48.15 (43.9)	45.2 (42.3)	46.68 (43.05)	8.68	10.42	9.55
7.	Cow urine @ 10% + Pot phosphonate @ 0.3 %	45.68 (42.5)	41.9 (40.3)	43.79 (41.38)	8.97	11.11	10.04
8.	Cow urine @ 10% + Cristol 56 SL @ 0.5%	40.74 (39.6)	41.8 (40.3)	41.27 (39.93)	7.96	11.37	9.67
9.	Cow urine @ 10% + *Pongamia pinnata* oil @ 0.5%	32.10 (34.5)	43.7 (41.4)	37.90 (38.00)	7.10	10.06	8.58
10.	Cow urine @ 10%	34.57 (36.0)	45.9 (42.6)	40.24 (39.35)	6.79	11.64	9.22
11.	Neem oil @ 1%	43.21 (41.1)	40.6 (39.6)	41.91 (40.34)	7.77	10.71	9.24
12.	Hexaconazole @ 0.1%	17.29 (24.6)	32.2 (32.6)	24.75 (29.80)	9.70	12.33	11.02
13.	Control	67.89 (55.5)	86.7 (68.6)	77.30 (61.48)	6.78	8.52	7.65
	S.E.±	2.29	1.98	3.92	1.36	0.948	0.43
	C.D. (P=0.05)	6.69	4.95	12.09	NS	NS	1.32
	CV (%)	10.1	15.51	12.80	20.2	15.51	6.55

NS-Non significant

host defense resulting in significant reduction in disease pressure when compared to untreated check (Table 1).The application of neem oil alone has not resulted in significant reduction in disease pressure. Thus, the study clearly indicated benefits of combined application of cow urine along with biorationals giving good protection against Asian soybean rust. The application of cow urine along with biorationals recorded at par seed yield with chemical control. This is a very good indication to develop an eco-friendly bio-intensive disease management strategy against Asian soybean rust in India. There is a need to further explore the role of defense genes being triggered by use of these elicitors leading to Induced Systemic Resistance (ISR) in soybean against Asian rust. The present investigations are the first line of research in managing Asian soybean rust by utilization of ITK measures. The successful management of panama disease of banana caused by *Fusarium oxysporum* f. sp. c*ubense*, foot rot of black pepper, TMV of tobacco and Fusarium wilt of tomato by use of neem based products and ITK measures has been reported Shamarao Jahagirdar,1998; Shamarao Jahagirdar *et al*., 2000; 2003; 2008; HollyBorn and Steve Diver, 2005).

Conclusion:

The chemical elicitors like MnS04,Muti-k or plant based extracts like *A.vesica*.*Pongamia pinnata* oil and bioagent like *Trichoderma harzianum* along with cow urine be used in developing Integrated Disease Management strategies against Asian soybean rust in India which will help in reducing the chemical pesticides in long term sustainable management. The present findings drawn the first line of research on utilization of Indigenous Technology Knowledge in managing rust and enhancing both yield and quality parameters of soybean in India.

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