Environment & Ecology 35 (4A) : 2955—2957, October—December 2017
Website : environmentandecology. com ISSN 0970-0420

Management of Black Scurf (*Rhizoctonia solani*) of Potato Through Eco-Friendly Components

R. K. Bagri, Harshraj Kanwar

Received 6 January 2017 ; Accepted 9 February 2017 ; Published online 28 February 2017

Abstract Black scurf (*Rhizoctonia solani*) diseases of potato are becoming prominent in many potatoes growing state resulting in economic losses, since a decade. An experiment was conducted to find out more economical and eco-friendly management approaches, taking cv Kufri Bahar with six treatments involving bio-agents (*Trichoderma viride* and *Bacillus subtilis*) and boric acid application before storage alone, bio-fumigation (mustard should be sown at least one month before potato planting and should be used as green manure) and gypsum application.Minimum disease incidence (18.0) index (0.41) and highest tuber yield (27.35 t/ha) was noticed in 3% boric acid spray before storage alone followed by bio-fumigation (mustard should be sown at least one month before potato planting and should be used as green manure). These treatments can provide an effective, economical and eco-friendly management of potato tuber diseases.

Keywords Black scurf, Management, Potato, *Rhizoctonia solani.*

R. K. Bagri, Harshraj Kanwar*
Division of Plant Pathology,
Rajasthan Agricultural Research Institute,
Durgapura, Jaipur, SKN Agriculture University,
Jobner, Rajasthan, India
e-mail : harshrajkarwarudawat@gmail.com
*Correspondence

Introduction

Potato (*Solanum tuberosum* L.) is an annual, herbaceous and dicotyledonous plant belonging to genus *Solanum* and family Solanaceae. Potato is an important vegetable cash crop in India. The crop suffers from large number of soil and tuber borne diseases among which black scurf caused by *Rhizoctonia solani* Khun is predominant in many potato growing regions of the country. Diseases are one of the yield reducing factors, which causes low yield of potato. Black scurf disease symptoms can be found on all underground parts of the plant at different times during the growing season. Disease is pronounced when black selerotia cover the tuber surface. Under minimum disease severity it just lower down the market price but may not reduce the yield. Under severe conditions, when sclerotia cover more than 50% area hinders germination of tubers, if get germinated there will be poor plant growth and leads to low yield [1]. Although, the diseases do not af-

fect the yield quantitatively but deteriorate the quality and acceptability of tubers for seed adversely affecting the market price of the table potatoes. Indiscriminate use of pesticides (chemicals) for controlling diseases has done great harm to the human beings, animals, vegetations and environment as a whole. Increasing awareness among the consumers has drawn the attention of the farmers to shift to eco-friendly, non hazardous chemicals, bio-control agents and botanicals. Bio-formulations as well as bioactive products of plant origin being less persistent in environment, safe to mammals as well as non-target organisms, have therefore become the focus of attention these days.

Materials and Methods

A field experiment was conducted during the winter (*rabi*) season 2012-13 and 2013-14 at Agriculture Research Station, Agricultural University, Kota Rajasthan). In the present study efforts have been made to manage these disease with eco-friendly products viz. bio-agents (*Trichoderma viride* and *Bacillus subtilis*) and boric acid application before storage, bio-fumigation (mustard should be sown at least one month before potato planting and should be used as green manure) and gypsum application which are inexpensive, non-hazardous and more eco-friendly to the potato growers. Total six treatments were evaluted for this experiment (Table 1). The experiment was conducted using black scurf infested seed potatoes (40—60 g) of cv Kufri Bahar having 100% disease incidence (I), with average disease index (DI) 1.0—2.0 %. For application of *T. viride* and *B. subtilis* the formulations were sprinkled evenly over the seed tubers whose surface was made wet with water and tubers rolled to cover them with the bio-agents evenly. The treatments were applied immediately before planting of the seed tubers in field. Bio-formulations of *T. viride* and *B. subtilis* contained 1×10^7 and 1×10^8 c.f.u./g, respectively. Bio-fumigation of mustard is done at least one month before potato planting and should be used as green manure. 3% boric acid before storage alone and gypsum application is done at the time of planting . Planting was done in the afternoon hours in the third week of November in both the years. After the treatments seed tubers was planted at 60 × 20 cm spacing in 3 × 2 m plots (5 rows with 10 tubers each). Each treatment was replicated four times in a randomized block design. All other recommended practices required for cultivation of the crop were followed. The crop was harvested 100 days after planting (DAP). After that washing the tubers, black scurf disease incidence and intensity were recorded separately. Disease incidence and index were recoded after harvest on 100 tubers selected at random from each replication. Observations on per cent disease incidence were recoded as per the formula :

$$\text{Diseases incidence} = \frac{\text{No. of tubers infected}}{\text{Total tubers observed}} \times 100$$

Disease severity scale (0—5) for the assessment of black scurf of potato under field conditions

Table 1. Eco-friendly management of black scurf of potato.

Sl. No.	Treatments	Disease index	Disease incidence (%)	Total yield (t/ha)
T_1	Untreated disease tubers (control)	1.62	62	21.67
T_2	Tuber treatment with *Trichoderma viride* @ 8 g/kg at planting	0.80	37	24.24
T_3	Tuber treatment with *Bacillius subtilis* @ 0.25 % at planting	0.75	33	25.05
T_4	3% boric acid before storage alone	0.41	18	27.35
T_5	Bio-fumigation (mustard should be sown at least one month before potato planting and should be used as green manure)	0.70	31	25.36
T_6	Gypsum applicaton @ 200 kg/ha	0.99	51	23.59
	CD at 5%	0.08	3.0	1.11
	SEm±	0.03	1.04	0.39

Disease severity grades	Percentage of disease
0	No disease symptoms
1	<1% tuber surface affected
2	1 to 10% tuber surface affected
3	11 to 20 % tuber surface affected
4	21–50% tuber surface affected
5	>50% tuber surface affected

T. viride was obtained from Central Potato Research Station, Modal town, Jalandhar, (Punjab) and *B.subtilis* strain B_5 was obtained from Central Potato Research Institute campus, Modipuram , Meerut (Uttar Pradesh).

Results and Discussion

All the treatments significantly checked black scurf incidence and index over untreated control during both the years (Table 1). Least disease incidence of black scurf (18.0%) and index (0.41) with maximum yield (27.35 t/ha) were recorded in the treatment (T_4) with 3% boric acid spray before storage alone followed by treatment T_5 bio-fumigation (mustard should be sown at least one month before potato planting and should be used as green manure). Similar results found by seed treatment with 3% boric acid for 30 minutes has been identified as a safe chemical which can replace hazardous organomercurials for controlling black scurf (*Rhizoctonia solani*), common scab (*Streptomyces scabies*), dry rots (*Fusarium* spp.) and soft rots (*Erwinia* spp.) of potato [2]. The maximum diseases incidence of black scurf (62.0) and disease index (1.62) with minimum yield (21.67 t/ha) were recorded in treatment T_1 /untreated diseases tuber (Control) . The results confirmed these finding earlier reported earlier [3—5]. The results obtained in the present study are more encouraging with respect to the management of the economically important disease. Boric acid in our studies has shown good control of black scurf at 3% concentration while Arora [3] reported the treatment of *Trichoderma viride* after seed dressing with boric acid (1.5%) significantly minimized the black scurf disease on potato tubers. Evaluation of different isolates of *Trichoderma* spp. against *Rhizocotnia solani*, *Fusarium oxysporum* f. sp. *phaseolin* and *Drechslera tricirepentis*, significantly controlled the mycelial growth of pathogen as reported earlier [6— 9]. To conclude we can say that the bio agents, botanicals and organic amendment have potential to manage of black scurf of potato and aare non-hazardous and eco-friendly.

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