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Effect of Seed or Soil Treatment with Fungicides On the Control of Black Scurf of Potato

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Abstract: Experiments at Potato Research Farm, Sharan, Kaghan Valley indicated a highly significant reduction in the percent disease incidence and severity of black scurf (***Rhizoctonia solani*** Kuhn.) of potato with seed tuber treatment of fungicide Dithane M-45 @ 3% solution whether treated as whole or cut seed. The seed treatment with boric acid @ 3% solution, when treated and planted as cut seed, was found to be the most effective. However, it was not effective when whole seed was treated. The soil treatments with bleaching powder @ 30 kg ha^{-1} or elemental sulfur @ 400 kg ha^{-1} did not affect the disease index when treated as whole seed while reverse was the case with cut seed potatoes.

Key words: Potato black scurf, chemical control, seed or soil treatment, Kaghan valley

Introduction

Potatoes are grown as summer cash crop in Kaghan valley (2038 to 2928 m elevation) of Pakistan and are supplied as seed to plains for ware production. The farmers' main constraint is the use of diseased seed over years (Zanoni, 1991; Jan and Hassan, 1995; Jan and Khan, 1995; Hussain ***et al.***, 1996). Black scurf is one of the serious disease problems deteriorating the seed tuber quality and causing economic losses in the valley.

The fungus (***Rhizoctonia solani*** Kuhn.), causing black scurf and stem canker of potato, survives in soil on dead tissues and on seed surfaces as masses of fungus cells. Black scurf causes qualitative damage as it decreases the marketability of tubers. Major loss in tuber yield is due to the stem canker phase of the disease. The growing tips of potato sprouts are susceptible and in severe cases, potato stand can be reduced limiting the yields (Agrios, 1988; Carling ***et al.***, 1989; Powelson ***et al.***, 1993; Singh, 1995).

Use of disease free seed, seed and/or soil treatment with chemicals, proper water management, crop rotation and green manuring, have been recommended for the control of black scurf (Biehn, 1969; Davis ***et al.***, 1976; Hooker, 1986; Platt, 1989; Powelson ***et al.***, 1993; Singh, 1995). This study describes the effect of seed or soil treatment with fungicides on the control of this disease under local conditions.

Materials and Methods

The experiment included 5 treatments as 1): Control (no chemical used), 2): Seed treatment with boric acid at 3% solution (dip for 20 min), 3): Seed treatment with Dithane M-45 at 3% solution (dip for 20 min), 4): Soil treatment with stable bleaching powder at 30 kg ha^{-1} and 5): Soil treatment with elemental sulfur at 400 kg ha^{-1}. A multiple disease sick plot of pathogens ***Rhizoctonia solani*** and ***Spongospora subterranea*** causing black scurf and powdery scab of potato, respectively was used at Potato Research Farm, Sharan (Kaghan valley, Pakistan) during summer, 1998 and the experiment was laid out in randomized complete block design (RCBD). The seed or soil was treated in the respective treatments before planting.

In each treatment, 5 rows of potato variety Raja, each 5 m long and 0.75 m wide were planted on 20th June, 1998. The plant to plant distance was kept as 25 cm within rows and disease free medium sized (35-50 g) whole tubers were planted. The treatments were kept 75 cm apart to avoid the overlapping effect of each other. The experiment was repeated as such on another multiple disease sick plot at the same station on 21st June, 1998 and cut tubers of the same variety were treated and then planted due to shortage of seed. Data on percent incidence and severity of black scurf, as described by Ahmed ***et al.*** (1994), on 100 tubers in each treatment of both the experiments in three-central 5 m long rows were recorded at the time of harvest. The trials were harvested on 9 and 10th October, 1998 and the data were analyzed according to the Fisher's LSD test (Ott, 1988).

Results and Discussion

Initial plant stand of the crop was not affected by any of the chemical treatments at both the sites. The highest incidence of black scurf was found in the treatment with soil application of bleaching powder followed by control treatment, seed treatment with boric acid and soil treatment with the elemental sulfur respectively at the site-1. However, significant reduction in the percent disease incidence and severity was observed in the seed treatment with Dithane M-45 at the site-1 where whole seed was treated and planted (Table 1).

The results at the site-2, where cut seed was planted, indicate that seed treatments with boric acid or Dithane M-45 reduced the percent incidence and severity of black scurf both drastically at the minimum level. The soil application of stable bleaching powder also reduced the disease incidence as well as severity significantly followed by elemental sulfur (Table 1). Stable bleaching powder has been reported to be effective also in controlling soft rot and black leg of potato (Siani and Parasher, 1980).

Considering the mean index of the disease of both the sites, the results explain that the seed treatment with Dithane M-45 followed by seed treatment with boric acid reduced the disease intensity effectively and significantly (Table 1) while other treatments did not affect the disease. Previous studies indicate that use of disease free seed combined with seed treatment

Table 1: Effect of seed or soil treatment with fungicides on the control of potato Black scurf at Sharan (Kaghan valley), Pakistan during summer, 1998

	Black scurf (%) Site-1		Black scurf (%) Site-2		Black scurf (%) Mean of two sites	
Treatment	Incidence	Severity	Incidence	Severity	Incidence	Severity
Control (No chemical)	21.9^{b}	22.7^{c}	21.5^{c}	18.7^{c}	21.7^{c}	20.7^{c}
Seed treatment with Boric acid@ 3% solution	18.8^{b}	16.8^{b}	1.5^{a}	3.8^{a}	10.2^{b}	10.3^{b}
Seed treatment with Dithane M-45 @ 3% solution	8.3^{a}	10.8^{a}	2.5^{a}	4.3^{a}	5.4^{a}	7.5^{a}
Soil treatment with stable bleaching powder @ 30 kg ha^{-1}	29.6^{c}	19.1^{bc}	10.5^{b}	10.4^{b}	20.1^{c}	14.8^{bc}
Soil treatment with elemental sulfur @ 400 kg ha^{-1}	18.5^{b}	18.5^{bc}	14.0^{b}	14.6^{bc}	16.3^{c}	16.6^{c}

Means followed by the same letter (s) are not significantly different from one another according to the LSD test at P=0.05, Site-1 = Whole seed planted, Site-2 = Cut seed planted

such as the systemic fungicides benomyl, thiabendazole, corboxin, or soil treatment of benomyl or pentachlro-nitrobenzene (PCNB) can effectively reduce the disease inoculum (Hooker, 1986; Singh, 1995). These chemicals are expensive and also not easily available in the market, therefore, the returns may not justify the cost.

It was concluded that use of Dithane M-45 @ 3% when applied to either cut or whole seed and boric acid @ 3% when applied to only cut seed potatoes, can effectively minimize the disease levels on the surfaces of tubers. Dipping of seed tubers for 20 min in 3% boric acid solution has also been found very effective in suppression of sclerotia on the tuber surface at Shimla, India (Singh, 1995). The potato farmers usually use cut seed potatoes for planting in spring as well as in summer. Boric acid is easily available in the market and is less expensive than the others. This chemical has also been found effectively controlling the powdery scab of potatoes (Jan, 2002).

In Pakistan, black scurf or stem canker of potato has been recorded as one of the fourteen major potato diseases commonly occurring in almost all the production zones (Ahmad ***et al.***, 1995; Javed, 1995; Khan ***et al.***, 1995). This wide occurrence indicates the need for greater emphasis on integrated management practices including use of healthy seed, seed treatment, good drainage, shallow planting, eradication of weeds and use of cereals in long rotations that can reduce damage by ***R. solani***. It is known that spread of the disease is largely due to planting of infected seed tubers or use of infested soil (Hooker 1986; Javed 1995; Singh 1995; Jan 2002). If awareness of the farmers is not enhanced and remedial measures are not taken, the disease is likely to spread very fast with the unlocked flow of seed to more new areas.

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