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Effect of Seed or Soil Treatment with Fungicides on the Control of Powdery Scab of Potato

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Abstract: Experiments conducted at Potato Research Farm, Sharan (Kaghan valley, Pakistan) during summer, 1998 indicated the lowest percent incidence and severity of potato powdery scab [*Spongospora subterranea* (Wallr.) Lagerh]; with pre-plant seed treatment of boric acid @ 3% solution or soil application of elemental sulfur @ 400 kg ha^{-1}. The soil application of stable bleaching powder @ 30 kg ha^{-1} also reduced the powdery scab index significantly. However, the seed treatment with fungicide Dithane M-45 @ 3% solution did not affect the disease intensity.

Key words: Potato, powdery scab, chemical control, Kaghan valley

Introduction

Potatoes are grown as summer cash crop in upper Kaghan valley of Pakistan and are supplied as seed to plains of the country for ware production. The farmers' main constraint is the use of diseased seed over years (Zanoni, 1991; Jan and Khan, 1995; Jan, 1996; Hussain *et al.*, 1996 and Jan, 1999). Powdery scab, caused by the fungus *Spongospora subterranea* (Wallr.) Lagerh; is one of the serious disease problems of potato deteriorating the seed tuber quality and causing economic losses in the valley.

The disease is spread by soil and by tuber-borne resting spores. Tuber and root infection is favored by cool, moist soil conditions in the earlier stages and later by gradual drying of the soil (Bhattacharya and Sheoraj, 1981 and Hooker, 1986). Infection on roots and stolons develops milky white galls, which may become so severe that young plants wilt and die (Singh, 1995). In storage, powdery scab may lead to a dry rot or cankers. Its lesions may serve as infection courts for late blight and a number of wound pathogens. The fungus also attacks under-ground parts of tomato and other species of *Solanum* (Hooker, 1986 and Singh, 1995).

Use of disease free seed, sanitation, proper water management, rotation with non-host crops and pre-plant treatment of seed or soil with chemicals may reduce the scab inoculum (Taylor *et al.*, 1981; Hooker, 1986; Powelson *et al.*, 1993 and Singh, 1995).

The study describes the effect of seed or soil treatment with fungicides on the control of powdery scab under local conditions at Potato Research Farm, Sharan (Kaghan valley).

Materials and Methods

The experiment included 5 treatments, (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 *Spongospora subterranea* and *Rhizoctonia solani* causing powdery scab and black scurf of potato respectively, was used at Potato Research Farm, Sharan and the experiment was laid out in Randomized Complete Block Design. 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 between 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 planted due to shortage of seed.

The crop of both the experiments was protected from late blight by spraying fungicide Dithane M-45 during August and September. The trials were harvested on 9th and 10th October, 1998. Data on percent disease incidence and severity of powdery scab as described by Ahmad *et al.* (1994) on 100 tubers in each treatment of both the experiments were recorded at the time of harvest and were analyzed according to the Fishers LSD test (Ott, 1988).

Results and Discussion

The lowest percent incidence of powdery scab (4.3%) was observed in the seed treatment with boric acid or 6.4% with soil application of elemental sulfur while the highest percent incidence of the disease (27.3%) was found in the seed treatment with Dithane M-45 followed by control (20.7%). The soil treatment with stable bleaching powder also reduced the disease incidence (8.0%) significantly (Table 1). Similarly, significant reductions were seen in the percent severity of the disease (3.5%) when the seed was treated with boric acid or 4.2% when the soil was applied with elemental sulfur or 6.2% stable bleaching powder. However, the seed treatment with Dithane M-45 did not affect the disease severity (14.6%). The results of both the experiments seem to be relevant with one another (Table 1). At both the sites, the percent germination and initial plant stand was not affected by any of the chemical treatments.

The results indicate that use of boric acid as pre-plant seed treatment or soil application of stable bleaching powder has proved to be effective by reducing the disease incidence as well as

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

	Powdery scab (%) (Site 1)		Powdery scab (%) (Site 2)		Powdery scab (%) (Mean of two sites)	
Treatments	Incidence	Severity	Incidence	Severity	Incidence	Severity
Control (No chemical)	27.4b	18.2c	14.0c	6.8b	20.7c	12.5c
Seed treatment with Boric acid @ 3% solution	07.5a	05.4a	01.1a	1.6a	04.3a	03.5a
Seed treatment with Dithane M-45 @ 3% solution	33.1c	21.8d	21.5d	7.5b	27.3d	14.6c
Soil treatment with stable bleaching powder @ 30 kg ha^{-1}	07.5a	08.5b	08.5b	3.9a	08.0b	06.2b
Soil treatment with elemental sulfur @ 400 kg ha^{-1}	09.0a	05.3a	03.8a	3.1a	06.4a	04.2a

Means followed by the same letter are not significantly different from one another according to the LSD test at P=0.05

severity significantly. Soil application of elemental sulfur appears to be beneficial by reducing the powdery scab index but seems to be the indirect effect of sulfur through its influence on soil pH (Brady, 1974). Its use is limited because soil may be made too acidic for optimum potato growth (Hooker, 1986) and may also affect other necessary crops unfavorably that are grown in rotation with potato in the area.

Previous studies indicate that powdery scab has emerged with high incidence in some areas of Pakistan (Turkensteen, 1987 and Ahmad *et al.*, 1994). It is known that spread of the disease is largely due to planting of infected seed. However, if immediate control measures are not taken, the disease is likely to spread very fast with the unlocked flow of seed to other areas of the country.

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