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Effect of Time of Application of Dithane M-45 on Control of Black Scurf Disease of Potato

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Abstract: The effect of time of application of fungicide Dithane M-45 on black scurf disease and yield in potato was investigated. The fungicide was applied at the rate of 500 ppm two weeks before planting, at the time of planting and two weeks after planting the potatoes. All the three treatments were effective in reducing the disease when compared with the control. The fungicide application at the time of planting (T_2) showed the lowest incidence (28.37%) and severity (2.71%) of the disease. However, fresh root weight, plant weight, plant height, number of tubers/plant, tuber size and yield were not significantly different in this than other treatments.

Key words: Potato, black scurf, *Rhizoctonia solani*, fungicide, time of application, Pakistan

Introduction

Potato yields in Pakistan are low due to many factors. Among these different seed and soil borne diseases are note worthy (Zanoni, 1991). These diseases have caused tremendous loss over the years in past. Black scurf caused by *Rhizoctonia solani* Kuhn, caused 11% reduction in germination, 70.4% number of stems and 68.2% in yield (Banville, 1989). On the other hand it increased post emergence wilting (27.2%), number of necrotic stems (98.8%) and aerial tuberization (14.7%) in field grown with susceptible variety. The net result was 100% scurf in harvested tubers (Lakra, 1992). In order to obtain economically profitable yield, it is necessary to avert huge losses. Different methods of control have been employed with a varying degree of success. One of these is the fungicidal control. This is because the fungicides adhere properly to the surface and protect the entire exposed area. Furthermore, they are readily available in the market, easy to handle and less time consuming than other control measures. Scheid (2000) reported that seed potato treatment with Monceren or Risolex were effective in controlling *R. solani*. Westerdijk and Ridder (1998) obtained best control of *R. solani* with Monceren. Welsh and Callaghan (1996) noticed that fungicides fenpiclonil (50g/ton) gave significant disease control of *R. solani* on tubers harvested a short time after haulm desiccation. This investigation was designed to study the effect of time of application of Dithane M-45 on disease severity and subsequent yield in potato.

Materials and Methods

Isolation of *Rhizoctonia solani*: Isolation was made from surface sterilized tubers using isolation technique reported by Reddy (1980). Small pieces of potato tubers bearing sclerotia were surface sterilized with 0.1% $HgCl_2$ for 15 sec and then rinsed with sterilized distilled water to remove excess of disinfectant and blotted dry on filter paper. Treated pieces were then placed on PDA medium in petri plates, incubated at 25°C for one week. Pure culture was obtained and used for further studies.

Preparation of inoculum: Forty petri plates containing PDA medium were inoculated with pure culture of *R. solani*. These plates were then incubated at 25°C for one week. The inoculum thus prepared was added to pots, which were used for planting the tubers.

Layout of experiment: Different treatments of the experiment included application of fungicide Dithane M-45 @ 500 ppm two weeks before planting, at the time and two weeks after planting. Pots without fungicide served as untreated (check). Each treatment was replicated ten times in a randomized complete block design. Soil was sterilized (121°C for 15 min),

cooled and put in earthen pots. Inoculum was added @ one plate/pot. One week after sowing nitrogenous fertilizer (urea) was added to the pots which were kept under natural day light at ambient temperature. Plants were harvested 12 weeks after planting.

Data recording: Data were recorded on disease incidence, disease severity, fresh root weight, plant height, number of tubers/plant, tuber size and tuber weight/plant. For recording disease severity on tubers, a 0-5 scale was used, wherein 0=no symptoms on potato tubers; 1=less than 1% tuber area affected; 2=1-10% tuber area affected; 3=11-20% tuber area; 4=21-50% area affected; and 5=51% or more tuber area affected (Ahmad *et al.*, 1991). Disease incidence was recorded as percentage of tubers infected per treatment.

Statistical analysis: Data were subjected to analysis of variance (ANOVA). Treatments showing significant differences were subjected to least significant difference (LSD) test, Correlation and regression for disease and yield parameters were worked out (Steel & Torrie, 1960).

Results

Disease incidence: Effect of application of Dithane M-45 on disease incidence was significant ($P=0.05$). The least disease incidence (28.37%) was recorded in treatment where Dithane M-45 was applied @ 500 ppm at the time of planting (T_2). The highest mean disease incidence (56.49%) was observed in treatment without any fungicide application (T_4). The latter treatment showed 28.12% higher disease incidence than former.

Disease severity: Significant differences were observed among different treatments (Table 1). The lowest disease severity was recorded in treatment where fungicide was applied at the time of planting (T_2), while the highest value was in treatment without any application of fungicide (T_4). These two treatments differed by 3.4% from one another. A significant and positive correlation ($r=0.999$) was calculated between incidence of black scurf and severity.

Fresh root weight: Significant differences were calculated among different treatments. The highest fresh root weight was recorded in treatment with fungicide application two weeks after planting (T_3), while the lowest in treatment without any fungicide application (T_4). The two treatments differed by 53.45% from one another. T_3 was the best which caused 16.88% and 9.46% increase in root weight over that of T_2 and T_1 respectively.

Zeb et al.: Fungicide application time effect on potato black scurf

Table 1: Effect of time of application of Dithane M-45 on incidence and severity and yield of potato.

Time of application of Dithane M-45	Disease incidence (%)	Disease severity (%)	Fresh root weight (g)	Fresh plant weight (g)	Tuber size (cm)	Plant height (cm)	No. of tubers /plant	Yield (gm/plant)
(T ₁): Two weeks before planting	38.21 b	3.833 b	12.93 a	86.86 ab	3.107 a	60.30	7.2	43.5 ab
(T ₂): At the time planting	28.37 b	2.713 b	11.86 ab	77.68 b	2.59 ab	57.00	5.9	35.26 ab
(T ₃): Two weeks after planting	40.10 ab	4.023 b	14.27 a	94.79 a	3.622 a	64.10	8.6	55.41 a
(T ₄): No fungicide	56.49 a	6.103 a	9.30 b	73.37 b	1.881 b	53.90	5.3	29.83 b
LSD at 0.05	17.641	1.913	2.963	15.272	1.165	58.825	2.801	23.88

Figures followed by different letter(s) in the same column are significantly different (P=0.05) from one another according to least significant difference (LSD) test.

Fresh plant weight: Fungicide treatment had a significant effect (P=0.05) on fresh plant weight. The highest fresh plant weight (94.79 g) was observed in T₃. A negative and significant correlation (r =0.875) was worked out between the disease severity and plant weight.

Plant height: Non significant differences were recorded among different treatments. The maximum plant height (64.1 cm) was recorded in treatment having fungicide application two weeks after planting (T₃). The shortest plants with a mean of 53.9 cm were in treatment having no fungicide application (T₄). This indicated a difference of 18.92% between the two treatments.

Number of tubers/plant: The highest number of tubers was recorded in treatment with fungicide application two weeks after planting (T₃) and the lowest in treatment without any fungicide application (T₄). Two treatments differed by 62.26% from one another. This showed the significant role of fungicide application in increasing the number of tubers/plant.

Tuber size: Fungicide treatment showed increase over the control. The highest increase (92.6%) was recorded in treatment where fungicide was applied two weeks after planting (T₃) and lowest increase (37.7 cm) within treatment with fungicide application at the planting time (T₂). Difference between these two treatments (T₃ and T₂) was higher (54.9%) than that between T₃ and T₁ (27.4%) indicating that application of fungicide two weeks before planting was better than its applications at the time of planting.

Yield: Yield of different treatments differed significantly from one another (P=0.05). In general fungicide treatment gave higher yield than no treatment and so the former helped increasing the yield. Among the fungicide treatments, the highest yield was obtained from treatment with fungicide application two weeks after planting (T₃). It yielded higher than that of treatments T₂ and T₁, respectively.

Discussion

Fungicide Dithane M-45 @ 500 ppm at planting time was more effective than other applications in reducing black scurf disease. Bradshah and Thomas (1992) reported that fungicide formulation MON -24082 and MON -24045, when applied as water based mist or dust at planting time reduced incidence of *R. solani*. Mantecon (1988) reported that all methods of application of fungicides, including dusting, spraying or immersion of seed potato pieces in fungicides run before planting were equally effective in controlling *R. solani*. Scheid (2000) observed that treatment of seed potato with pencycuron or tolclofos-methyl reduced the amount of infected tissue of *R. solani* and increased the marginal yields. Welsh and Callaghan (1996) reported that tuber treatment with fenpiclonil gave similar level of control of *R. solani* as with tolclofos-methyl and benomyl. Golbniak et al. (1993) found effective control of *R. solani*, when seed tubers were treated with Dithane-M45 and two formulations of Rizolex. The non-significant differences on disease and other parameters being studied indicated that preplanting application

of Dithane M-45 may also prove effective in some cases. Leadbeater and Kirk (1992) tested fenpiclonil a broad spectrum fungicide against the seed borne diseases including black scurf and found that the fungicide controlled these diseases when applied as pre-planting seed tuber treatment. Literature on positive effect of post planting application of fungicide is very scant. In this study this effect was also not as significant as in other two cases. Probably fungicide application required sufficient time to minimize the inoculum load present in the soil or on surface of potato tubers. This did not happen in this case and so neither the disease was affected so adversely nor the yields were increased substantially. Treatment of soil with fungicides helped in increasing the per plant yield and other agronomic traits. This proved the superiority of soil treatment over the no treatment with fungicide. Bud (1989) reported that fungicide PCNB and Dithane M-45 resulted in more plant vigor and plant stand as compared to control.

This investigation showed that Dithane-M45 application at time of planting caused the lowest incidence and severity of black scurf. However, the effect of this treatment was similar to other treatments on yield parameters in potato.

References

Ahmad, I., M. H. Soomro, S. Iftikhar and M. Aslam, 1991. Investigations on powdery scab of potato in Pakistan. CDR/PSFDP, Pak. Agrl. Res. Council Islamabad, Pakistan, pp:50.

Banville, G.T., 1989. Yield losses and damage to potato plants caused by *Rhizoctonia solani* Kuhn. Amer. Potato J., 66: 821-834.

Bradshah, N.J. and J.M. Thomas, 1992. Evaluation of fungicide formulations. MON-24082 and MON-24045 against stem canker in early potatoes. Tests of Agrochemicals and Cultivars 13: 22-23.

Bud, H.W., 1989. Potato growth and tuber production as affected by inoculation of cut and whole seed with use of treatment fungicides. Amer. Potato J., 66: 365-378.

Golbniak, B., Z. Weber and C.M. Smith, 1993. Chemical control of *Rhizoctonia* spp. on potato and wheat. Phytopathologia Polonica, 18: 45-54.

Lakra, B.S., 1992. Correlation of infection intensities of black scurf with yield components of potato. Ind. J. Mycol. Pl. Pathol., 22: 203-204.

Leadbeater, A.J. and W.W. Kirk, 1992. Control of tuber-borne diseases of potatoes with fenpiclonil. Pests and Dis., 2: 657-662.

Mantecon, J., 1988. Effectiveness of chemical treatment in the control of potato black scurf. Rev. Pl. Pathol., 61: 129.

Reddy, M.V., 1980. Isolations and multiplication of *Ascochyta rabiei*. Pulse Pathol. Progr. Rept., 8: 11-12.

Scheid, L., 2000. When does treatment of seed potatoes pay off? Kartoffelbau, 51: 14-19.

Steel, R.G.D. and J.H. Torrie, 1960. Principles and procedures of statistics. McGraw-Hill Book Co., Inc., New York.

Welsh, R.D. and M. O' Callaghan, 1996. Evaluation of fenpiclonil as a potato seed tuber treatment for the control of *Rhizoctonia solani* and *Helminthosporium solani*. Proc. 49th New Zeal. Pl. Prot. Conf., Rutherford, Nelson., 152-156.

Westerdijk, C.E. and J. K. Ridder, 1998. Antagonist against *Rhizoctonia solani* in seed potatoes seem possible. PAV-Bulletin-Akkerbouw. 1998, No. August, 15-16.

Zanoni, U., 1991. Potato Atlas and Compendium of Pakistan. Pak. Swiss Potato Develop. Proj., PARC, Islamabad, pp: 258.