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Evaluation of Different Protectant and Eradicant Fungicides Against Early and Late Blight of Potato Caused by *Alternaria solani* (Ellis and Mart) Jones and Grout and *Phytophthora infestans* (Mont.) De Bary under Field Conditions

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Abstract: Recommended doses (200-250 gm acre⁻¹) of five protectant and eradicator fungicides viz Banko (Chlorothalonil) 500 Sc, Score (Difenoconazole) 250 Ec, AcrobatMZ 90/600 WP, Metalaxyl+Mancozeb) 72 WP and Ridomil Gold (Mancozeb+Metalaxyl) 68 WP were tested against early and late blight diseases development on ten potato advance lines/varieties sown in a randomized complete block design in the research area of a private farm at Chiniot. All the fungicides reduced disease severity on most of the lines/varieties significantly compared to untreated control. However the effect of Metalaxyl+Mancozeb (72 WP), Ridomil Gold (68WP), Score (250 EC) and Banko (500 Sc) was pronounced on tolerant or moderately resistant varieties/lines compared to moderately susceptible or susceptible varieties/lines. Genetic potential of such lines/varieties was greatly exploited by the application of these fungicides. Cultivations of resistant/moderately resistant varieties along with timely one or two sprays of these fungicides will be helpful to control these diseases.

Key words: Early blight, late blight, potato, *Alternaria solani*, *Phytophthora infestans*, fungicides.

INTRODUCTION

Early blight by *Alternaria Solani* (Ellis and Mart) Jones and late Blight by *Phytophthora infestans* (Mont.) de Bary are potential threats to potato production in Paksitan (Ahmed and Mirza, 1995) Early blight in hilly areas, especially the Kaghan valley there is tendency of increased incidence with altitude 1700 to 2400 m and in some fields 25% of the foliage may be affected (Mohibullah, 1995) In plain areas it appears usually in October. November when temperature is moderate to cool. While late blight was firstly recorded in 1984 from Kalam and Malamjaba valleys in Swat district (Khan *et al.*, 1985) since then late blight has been reported from potato growing plains of Punjab, NWFP, Balochistan and Northern areas of the country where micro-climate appears to be suitable for the disease. During the last few years early blight is occurring almost every year primarily due to the soil-borne survival of the fungus, local over wintering/over summering of inoculums, cultivation of susceptible varieties and favourable environmental conditions while late blight fungus is a cold climate pathogen, however it has tremendous capacity to adopt a variety of environments thus becoming wide spread in temperate as well as sub-tropical regions of potato production. Cultivation of resistant variety is a valid option in any of disease management strategy but when disease appears suddenly and at a very rapid rate in the

field, the farmers are left with no option except to spray the crop with some effective chemicals. The efficacy of some chemicals against early blight (Mathur *et al.*, 1971; Singh 1971, Dahmen and Stanb, 1992; Singh, 1998) and late blight (Matheron and Matejka, 1991; Ghani *et al.*, 1995; Shuja, 1995) has been reported by different workers . The objective of these studies was to evaluate the effect of five fungicides against commercially grown varieties as well as some advanced lines of potato against both of the diseases.

MATERIALS AND METHODS

Seed of potato varieties/advanced lines was collected from vegetable section, AARI, Department of plant pathology, University of Agriculture, Faisalabad and Haji sons Farms (Pvt.) Chiniot. These advanced lines/varieties were planted in randomized complete block design with three replications at research trial area of Haji Sons Farms (Pvt.) Kot Mirza (CHINIOT) during winter season 2002-2003. Each variety/advance line was sown at 30 cm plant to plant and 60 cm row to row distance, each variety/advance line served as block and treatments were randomized in the blocks.

Five protectant and eradicator fungicides viz Banko (Chlorothalonil) 500 Sc, Score (Difenoconazole) 250 EC, Acrobat MZ 90/600 WP, Metalaxyl + Mancozeb 72 WP and Ridomil Gold (Mancozeb + Metalaxyl) 68 WP were

applied at 200-250 gm acre⁻¹. Except Diphanconazole applied at 120 ml acre⁻¹.

Untreated rows of each varieties/lines served as check. First spray of the fungicides was conducted immediately after the initial appearance of disease symptoms. It was scheduled to conduct the 2nd spray after 10-days interval. Since the disease (early blight) was effectively controlled so second spray was not done to save time and money. For late blight, the same schedule was followed starting from the initial appearance of disease symptoms. The data on disease severity were recorded one day before spray and 10- days after spraying using 0-4 grade scale of Reifschneider *et al.* (1984) for early blight and 0-5 grade scale (Anonymous, 1985) for late blight and was statistically analyzed (Steel and Torrie, 1980)

RESULT AND DISCUSSION

Symptoms of early blight were visible on December 2,2002 in the form of small isolated, scattered pale brown spots on the leaflets. These spots became covered with deep greenish blue growth of the fungus. Lower leaves attacked 1st . and the disease progressed upward in the next few days. Since natural inoculum was relied upon for infection so disease symptoms were initiated from the previous years potato crop.

It has been well documented by Shtienberg and Fry (1990) that in the fields where the previous crop was potato or tomato, the early blight lesions on the current season potato crop appeared early in both the resistant and susceptible varieties. There were no early blight symptoms on potato clone 332830 and 332827 indicating their highly resistant response. Matalaxly+Mancozeb and Acrobat MZ reduced the early blight disease severity significantly compared to untreated control (Table 1). Score 250 Ec and Banko 500 Sc reduced the disease severity in sprayed plots of cardinal, 332828, 332831 Diamont, 332832, 332825, FD-1-7 and 332824 compared to check. According to Dahman and Staub, (1992) difenoconazole (Score 250 Ec)was found to very effective against early blight because of its protectant, curative and eradicant mode of action especially its lasting protective activity up to 3 weeks) is provided great flexibility in number and timing of spray. Chemical control of early blight by foliar application of Antracol and Dithane M-45 (Mancozeb) has been reported (Shuja, 1995, Siddiqui *et al.*, 1995). Dithane (Mancozeb) M-45 has been reported as very effective fungicide against early blight having protective and eradicative properties (Razvi, 1995).

Symptoms of late blight appeared in January 2003 in the form of blighted areas consisting of faded green patches turning to brownish black. These lesions were not delimited in size and enlarging rapidly and leaf tissues was becoming necrotic.

Table 1: Evaluation of fungicides against early blight disease under field conditions

S. No.	Name of variety/ advance line	Untreated control	Methalazyl+ Mancozeb 72 WP		Redomil gold 68 WP		Score 250 EC		Banko 500 Sc		Acrobat MZ 90/600 WP		LSD
			%age early blight disease severity										
1.	332830	0.00a	0.00a	0.00a	0.00a	0.00a	0.00a	0.00a	0.00a	0.00a	0.00a	0.00a	0.00
2.	332828	1.66a	0.33a	0.50a	0.33b	0.50a	0.33b	0.50a	0.33b	0.50a	0.33b	0.33b	0.00
3.	Diamont	2.00a	0.33a	0.50b	0.33a	0.50b	0.33a	0.50b	0.33a	0.50b	0.33b	0.33b	0.00
4.	332824	2.00a	0.50a	0.33a	0.66a	0.33a	0.66a	0.66a	0.66a	0.66a	0.66a	0.66a	0.33
5.	332832	1.33a	0.50b	0.16a	0.66a	0.16a	0.66a	0.50a	0.66a	0.50a	0.66a	0.66a	0.58
6.	332831	0.66a	0.33a	0.50b	0.66a	0.50b	0.66a	0.50a	0.66a	0.50a	0.33b	0.33b	0.23
7.	Cardinal	0.00a	0.33b	0.33a	0.33b	0.33a	0.33b	0.33b	0.33b	0.33b	0.33b	0.33b	0.46
8.	332827	1.00a	0.00a	0.00a	0.00a	0.00a	0.00a	0.00a	0.00a	0.00a	0.00a	0.00a	0.00
9.	FD-1-7	1.00a	0.50b	0.50b	0.50a	0.50b	0.50a	0.33b	0.50b	0.50b	0.50b	0.50b	0.00
10.	332828	2.00a	1.00a	0.50b	2.0a	0.50b	2.0a	2.0a	2.0a	0.66a	0.66a	0.66a	0.24

Table 2: Evaluation of Fungicides against late blight of potato disease under field conditions

Name of variety advance line	Untreated control (before spray)	Methalazyl+ Mancozeb 72 WP		Redomil gold 68 WP		Score 250 EC		Banko 500 Sc		Acrobat MZ 90/600 WP		LSD		
		%age late blight disease severity												
		1st Spray	2nd spray	1st Spray	2nd spray	1st Spray	2nd spray	1st Spray	2nd spray	1st Spray	2nd spray		1st Spray	2nd spray
1.	332830	0.00a	0.00b	0.00a	0.00b	0.00a	0.00b	0.00a	0.00b	0.00a	0.00b	0.00a	0.00	
2.	332825	3.33a	2.00b	1.00b	2.00b	1.00c	2.00b	0.66b	2.00b	1.00b	2.00b	0.66b	0.38	
3.	Diamont	2.33a	1.00b	0.33c	1.00b	0.00c	1.00b	0.00a	1.00b	0.00a	1.00b	0.00c	0.24	
4.	332824	1.66a	1.00b	0.00c	1.00b	0.00b	1.00b	0.00a	1.00b	0.00a	1.00b	0.66b	0.00	
5.	332832	2.33a	1.66b	0.66c	1.66b	0.66c	1.66b	0.33b	1.66b	0.66b	1.66b	0.66b	0.24	
6.	332831	2.66a	1.66b	0.66b	1.66b	0.33c	1.66b	0.66b	1.66b	0.66c	1.66b	0.66b	0.48	
7.	Cardinal	2.66a	1.66b	0.00a	1.66b	0.00b	1.66b	0.00a	1.66b	0.00a	1.66b	0.00c	0.24	
8.	332827	3.00a	1.66b	0.66c	1.66b	0.33b	1.66b	0.66b	1.66b	0.66b	1.66b	0.33a	0.29	
9.	FD-1-7	1.66a	1.00b	0.00b	1.00b	0.00a	1.00b	0.00a	1.00b	0.00a	1.00b	0.00c	0.00	
10.	332828	2.66a	1.66b	0.66c	1.66b	0.66c	1.66b	0.66b	1.66b	0.33c	1.66b	0.33a	0.29	

* Means sharing different letters in row are significantly different as determined by least significant difference test at P= 0.05

At the time of 1st spray, there was uniform spread of the disease on most of the varieties/lines. There was no disease symptoms on the potato clone 332830 showing its highly resistant status among the varieties/lines. After the 2nd spray of Metalaxyl+ Mancozeb, Ridomil Gold Score 250 Ec, Banko 500 Sc and Acrobat MZ, disease reduction was much pronounced as indicated by the complete inhibition of disease symptoms on the varieties/lines i.e. 332825, diamond, 332824, cardinal and FD-1-7 respectively (Table 2). All the fungicides significantly reduced the late blight disease severity compared to untreated control, however on some varieties/lines i.e. 332828, 332831, 332827, 332832, Ridomil Gold, Score 250Ec and Banko 500Sc have poor control even after the 2nd spray. This may be attributed to differential response of varieties/lines to a particular group of fungicide

Metalaxyl being a member of acylalanine group and is characterized by its systemic activity (Cooke *et al.*, 1981), provides control when applied as foliar spray . by reducing spore germination intercellular growth of the fungus and sporulation . Ridomil Gold reduces both growth and sporulation of the fungus while Mancozeb only inhibits spore germination. Two sprays of these effective fungicides will successfully control the disease. Banko 500Sc and Score 250 EC were also effective against the disease being protective, curative and eradicated properties . Acrobat MZ is newly introduced effective fungicide having protective, curative and antispore properties which provides long residual protection. (Anonymous 2002). Incorporation of cultivars resistance in a reduced spray strategy to suppress late and early blight of potato has been emphasized by Shtienberg *et al.*, (1990)

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