

Control of Late Blight of Potato by Foliar Application of Fungicides

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ABSTRACT

Five fungicides viz., Acrobat MZ 90/600 WP, Metalaxyl + Mancozeb 72 WP, Ridomil Gold (Mancozeb + Metalaxyl) 68 WP, Banko (Chlorothalonil) 500 SC and Score (Difenoconazole) 250 EC were tested at 200 g/A against late blight disease developed on 30 varieties/lines under natural conditions. All the fungicides reduced disease severity on most of the varieties/lines significantly compared to untreated control. Rate of disease development was slower in moderately resistant varieties/lines compared to susceptible varieties/lines. The genetic potential of such varieties/lines was greatly exploited by application of these fungicides as indicated by the complete inhibition of disease symptoms after 2nd spray. Cultivation of resistant/moderately resistant varieties combined with one or two sprays of any these fungicides would be helpful to control late blight of potato successfully.

Key Words: Late blight; Potato; Fungicides; *Phytophthora infestans*

INTRODUCTION

Late blight of potato caused by *Phytophthora infestans* (Mont.) de Bary is a potential threat to potato production in Pakistan because of its increasing distribution and severity (Ahmad & Mirza, 1995). This disease was reported for the first time in Pakistan in 1984 from Kalam and Malam Jaba 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. Although the fungus causing this disease is a cold climate pathogen, however, it has tremendous capacity to adapt to a variety of environments, thus becoming widespread in temperate as well as sub-tropical regions of potato production (Ahmad & Mirza, 1995). *Phytophthora infestans* is a potentially dangerous fungus because it spreads at very fast rate and if timely spraying of fungicides is not done its devastating effects cannot be checked, which may result in huge crop losses.

Cultivation of resistant varieties is the most economical method to manage late blight. But when the disease appears suddenly and at a very rapid rate in the field, farmers are left with no option except to spray the crop with some effective chemicals. Although, the efficacy of some chemicals against late blight has been reported (Ghani *et al.*, 1995; Matheron & Matejka, 1991; Shuja, 1995), but large scale testing of fungicides against late blight has not been reported from Pakistan so far. The objective of these studies was to evaluate some protectant and eradicant fungicides against late blight of potato appearing under natural conditions on thirty varieties/lines.

MATERIALS AND METHODS

Experiment was conducted on large scale involving thirty varieties/lines obtained from Vegetable Research Institute, AARI, Faisalabad and Potato Programme, NARC, Islamabad. These advanced lines/varieties were planted in three sets based on the quantity of potato seed and availability of field area, in a randomized complete block design with three replications. Each variety/line was sown in 15 meter row. One set consisted of ten varieties/lines, thus each variety served as block and the treatments were randomized in the blocks.

Five fungicides viz., Diphenoconazole (Score 250 EC), Chlorothalonil (Banko 500 SC), Metalaxyl + Mancozeb (Ridomil Gold MZ 68 WP), Metalaxyl + Mancozeb 72 WP and Acrobat MZ 90/600 WP were applied at 200 g/acre, except Diphenoconazole applied at 120 ml/acre. Untreated rows of each varieties/lines served as check. First spray of the fungicides was conducted immediately after the initial appearance of disease symptoms. Second spray was conducted after 15 days interval. The data on disease severity were recorded one day before spray and at weekly intervals after spraying using 0-5 scale (Anonymous, 1985) and statistically analysed (Steel & Torrie, 1980).

RESULTS AND DISCUSSION

Symptoms of late blight appeared on January 18, 2003 in the form of blighted areas consisting of faded green patches turning to brownish black. These lesions were not delimited in size and enlarged rapidly and leaf tissue became necrotic. At the time of first spray there was

Table I. Evaluation of fungicides against late blight disease under natural conditions

Varieties/lines	Untreated Control	Metalaxyl + Mancozeb	Ridomil Gold	
SET I		% early blight disease severity		
	<i>Before spray</i>	<i>1st spray</i>	<i>2nd spray</i>	<i>LSD</i>
393574-61	2.00 a	1.66 b	0.66 c	0.24
FD-22-3	2.33 a	2.00 b	1.00 c	0.29
393009-1A	1.33 a	1.00 b	0.00 c	0.29
FD-23-1	2.33 a	1.33 b	0.33 c	0.38
FD 1-7	2.66 a	1.00 b	0.00 c	0.29
Diamont	1.33 a	1.00 b	0.00 c	0.24
391202-40	0.00 a	0.00 a	0.00 a	0.00
SH-20	1.33 a	1.00 b	0.33 c	0.24
9717	2.66 a	2.00 b	1.33 c	0.29
332824	1.00 a	0.00 b	0.00 b	0.00
SET II	<i>Untreated Control</i>	<i>Score 250 EC</i>	<i>Banko 500</i>	<i>LSD</i>
Cardinal	1.00 a	0.67 b	0.00 c	0.24
TPS 9803	1.66 a	0.33 b	0.00 a	0.29
SH-5	2.33 a	2.00 b	1.00 c	0.24
FD-1-3	1.33 a	0.00 b	0.00 b	0.24
394007-55	1.33 a	1.33 a	1.33 a	0.00
332825	3.00 a	2.77 a	0.66 b	0.46
332826	3.00 a	2.00 b	0.66 b	0.48
332827	1.00 a	1.00 a	1.00 a	0.00
332828	1.00 a	1.00 a	1.00 a	0.00
332829	3.00 a	3.00 a	1.66 b	0.24
SET III	<i>Untreated Control</i>	<i>Acrobat MZ 90/600</i>	<i>2nd spray</i>	<i>LSD</i>
393619-44	3.00 a	2.33 b	1.66 c	0.29
FD-4-2	1.00 a	0.33 b	0.00 c	0.24
394054-4	1.00 a	0.11 b	0.00 c	0.18
FD-5-3	2.33 a	1.33 b	0.66 c	0.24
332830	0.66 a	0.00 b	0.00 b	0.24
332831	2.00 a	1.00 b	0.33 c	0.29
332832	1.66 a	1.33 b	1.00 c	0.29
TPS 9804	0.00 a	0.00 a	0.00 a	0.00
TPS 9820	1.66 a	1.33 b	0.66 c	0.24
Dura	2.00 a	1.00 b	0.33 c	0.28

Means sharing different letters in each column are significantly different at p 0.05

uniform spread of the disease on most of the varieties. Late blight disease severity was reduced significantly in Metalaxyl + Mancozeb, Ridomil Gold and Acrobat treated plots of majority of the varieties/lines (Table I). There were no symptoms of disease on 391202-40 and TPS 9804 indicating their highly resistant response to late blight disease. After the second spray disease reduction was much pronounced as indicated by the complete inhibition of disease symptoms on such varieties/lines i.e., 393009-1A, FD-1-7, Diamont, 332824, Cardinal, TPS 9808, FD-1-3, FD 4-2, 394054-4, and 332830 respectively (Table I). All the fungicides treated plots had significantly less disease severity compared to untreated control, however, on some varieties/lines i.e. 332827 and 332828 there was no effect of Score 250 and Banko. This may be attributed to differential response of varieties/lines to fungicides.

During early nineties late blight on potato had been successfully controlled by spraying Bordeaux mixture; it was replaced by Fytolan, Blitox-50 and Fycol-8E. During 1950-1970 broad spectrum dithiocarbamate fungicides such as Zineb (Dithane Z-78) and Mancozeb (Dithane M-45) became popular and were widely used for the control of late blight (Singh, 1998). In general the mode of action of fungicides like Mancozeb involves protection of the foliage

by inhibiting germination and/or penetration by the spores. The efficacy of these fungicides can be enhanced by increasing the dosage and frequency of application. For the effective control of late blight, timely and proper care to wet the foliage surface is highly desirable.

Metalaxyl is a member of acylalanine group and is characterized by its systemic activity (Cooke *et al.*, 1981). It provides control when applied as soil or tuber treatment at planting time and as foliar spray during the growing season. Systemic fungicides like Ridomil Gold are superior to protectant fungicides such as Dithane M-45, because they can enter and get distributed into the plant tissues thus less susceptible to weathering so less frequent applications may be required to control the disease effectively. Metalaxyl has been found to provide disease control by inhibiting spore germination, intercellular growth of the fungus and sporulation (Singh, 1998). It is an effective eradicator, inhibiting previously established infections. Ridomil MZ reduces both growth and sporulation of the fungus while mancozeb only inhibits spore germination. However, repeated use of this fungicide results in the development of resistant strains in *Phytophthora infestans*. This warrants the use of combinations of systemics and protectants. Two sprays of Ridomil MZ 68 WP and Metalaxyl + Mancozeb

72 WP successfully controlled late blight on potato varieties/lines (Singh, 1998). If the disease pressure is high then two sprays of these fungicides followed by one spray of Mancozeb would be sufficient to control late blight.

During these studies Banko (chlorothalonil) and Score (difenoconazole) were equally effective in controlling the disease. Score is also a protective, curative and eradicated fungicide and because of its long lasting activity (up to 3 weeks), it provides great flexibility in number and timing of sprays especially when combined with other fungicides. Acrobat MZ 90/600 g/kg WP is a newly introduced fungicide and is another excellent chemical in controlling the disease. It has good protective, curative and excellent antisporent properties and provides long residual protection (Anonymous, 2002).

Cultivation of resistant varieties in areas where late blight occurs frequently will not only ensure the best check of the disease but it will reduce the cost of chemical sprays. Incorporation of cultivar resistance in a reduced spray strategy to suppress late and early blight of potato has been emphasized by Shtienberg *et al.* (1994).

Acknowledgements. The support provided in the form of seed of five potato varieties/lines by the Haji Sons Potato Farms (Pvt), Lahore Road, Chiniot, is gratefully acknowledged. The authors are also thankful to different private companies providing free fungicides samples used in this experiment. The funds utilized partially in this experiment under the Pakistan Science Foundation Research Grant No. PSF/Res/P-AU/Agr (236) is also gratefully acknowledged.

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(Received 23 August 2003; Accepted 20 September 2003)