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RESEARCH NOTE

Evaluation of newer fungicide molecules against Late blight of potato

[1]ANJANEYA REDDY, B., [2]A. SREENATHA,
[3]R. MUNILAKSHMI AND [4]H. G. SUJATHA

[1,3,4]College of Horticulture, Bengaluru- 560 065
[2]Horticulture Research and Extension Centre,
Hogalagere, Karnataka, India.
Email:arb_agri@yahoo.co.in

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Potato (*Solanum tuberosum* L.) is a very important food and cash crop. The variety Kufri jyothi was evaluated for late blight of potato caused by *Phytophtora infestans* for disease progress and yield potential with the application of fungicides *viz.,* dimethomorph (1.0 g/lt), azoxystrobin (23 per cent) (1ml/lt), fenamidon+mancozeb (3gm/lt), equation pro (1ml/lt), cymaxanil+ mancozeb (3gm/lt), potassium phosphonate (3ml/lt), propiconazole (1ml/lt) and metalaxyl+ mancozeb (1.5gm/lt) was used as a control under field conditions during the main cropping *rabi* season in 2011-2012 and 2012-2013. The experiment was conducted in randomized complete block design. Fungicide applications in fifteen days intervals were established. Late blight infection was prevalent in the experimental year, and a significant amount of disease was detected ($P<0.05$). Application of fungicides considerably reduced late blight progress, with a corresponding increase in yield of potato. Among the different treatments, azoxystrobin (23 per cent) (1ml/lt) fungicide treated against potato found to be highly effective with (PDI 13.63 per cent), followed by fenamidon+mancozeb (3gm/lt) (PDI 24.50 per cent) and cymaxanil+ mancozeb (3gm/lt) (PDI 25.17 per cent). But propiconazole (1ml/lt) was found to be least effective with (PDI 76.00 per cent). The highest yield was obtained by the application azoxystrobin (23 per cent) (1ml/lt) (127.70q/ha), followed by fenamidon+mancozeb (3gm/lt) (119.05q/ha).

Key words: Disease, Fungicides, Late blight

Potato, popularly known as the 'King of Vegetables' is a starchy, tuberous crop (*Solanum tuberosum* L.), belonging to family Solanaceae. It originated from South America, in the mountains of southern Peru and Bolivia (Gupta *et al.,* 2008). About 152,956,115 million tons of potatoes were produced in the world 2012, and with a yield potential of up to 48.1 tons/ha (Anon, 2012). Farmers get lower yield mainly due to diseases, pests and sub-optimal fertilization. The most important factors responsible for the low productivity of potato are diseases and insect pests. Among those diseases, late blight is probably the single most important disease of potatoes and tomatoes worldwide (Son *et al.,* 2008). Worldwide, losses due to late blight are estimated to exceed $5 billion annually and thus the pathogen is regarded as a threat to global food security (Latijnhouwers *et al.,* 2004).

Late blight caused by *Phytophthora infestans* (Mont) de Bary is one of the most significant constraints to potato productions up to 90% of crop losses in cool and wet weather conditions in the country. Yield losses due to the disease are attributed to both premature death of foliage and diseased tubers in potato and foliage. The disease is more severe in humid and high rainfall areas and it occurs at a low intensity in dry areas. It causes serious loss in yield and quality as well as reduces its marketability values. Nonetheless, loss due to the disease was estimated to range between 65-70% and complete crop failures are frequently reported.

The management of potato crop against this pathogen is important to maximize the crops' yield. The disease occurs throughout the major potato production areas and it is difficult to produce crop during the main rainy season without chemical protection measures.

The experiments were arranged in randomized complete block design with variety Kufri Jyothi containing 8 treatments and 3 replications, plot size of 2.4 X 2.8 mt during the years 2011-12 and 2012-13 at College of Horticulture, Kolar, Karnataka. For the management of the disease eight fungicide treatments *viz.,* dimethomorph (1.0 g/lt), azoxystrobin (23 per cent) (1ml/lt), fenamidon+mancozeb (3gm/lt), equation pro (1ml/lt), cymaxanil+ mancozeb (3gm/lt), potassium phosphonate (3ml/lt), propiconazole (1ml/lt) and metalaxyl+ mancozeb (1.5gm/lt) were used. In this experiment, metalaxyl+ mancozeb (1.5gm/lt) was used as a standard check. The observations on PDI(Per cent Disease Index) were recorded at 15 days interval i.e. before every spray and also at 15 days after the final spray and the observations were converted to PDI using the formula given by Wheeler (1969).

$$PDI = \frac{\text{Sum of individual disease rating}}{\text{Number of observations assessed}} \times \frac{100}{\text{Maximum disease scale used}}$$

All the treatments showed significantly different level of late blight severity compared to control ($P<0.05$). The least percent disease severity was recorded in azoxystrobin (23 per cent) (1ml/lt) (PDI 13.63 per cent), followed by fenamidon+mancozeb (3gm/lt) (PDI 24.50 per cent) and cymaxanil+ mancozeb (3gm/lt) (PDI 25.17 per cent). But propiconazole (1ml/lt) was found to be least effective with (PDI 76.00 per cent). In control treatment, metalaxyl + mancozeb (1.5 gm/lt) (PDI 66.00 per cent) was recorded (Table 1).

The highest disease variation in yield losses was also observed among different treatments. The highest yield was obtained by the application of azoxystrobin (23 per cent) (1ml/lt) (127.70q/ha), followed by fenamidon+mancozeb(3gm/lt) (119.05q/ha), cymaxanil+ mancozeb(3gm/lt) (115.48q/ha). The lowest yield was obtained by the application of propiconazole (1ml/lt) (60.76q/ha). This is an indication of the reliability and promise as well as the exhibition of great potential of the azoxystrobin (23 per cent) (1ml/lt) for the effective control of the late blight of potato(Table 1).

The use of Sunoxanil 72 WP(Cymoxanil 8%+ Mancozeb 64%) as a best fungicide when applied as prophylactic measures as well as Sunoxanil 72 WP (Cymoxanil 8%+ Mancozeb 64%)

Table 1. Effect of different new fungicides on disease suppression and yield of potato

Treat-	Details	Per cent disease index			Yield (q/ha)		
ments		2011-12	2012-13	Mean	2011-12	2012-13	Mean
T_1	Dimethomorph (1.0 g/lt)	45.33 (42.32)	18.00 (25.10)	31.67	102.93	120.98	111.95
T_2	Azoxystrobin (23%)-1ml/lt	20.67 (27.04)	6.60 (14.89)	13.63	117.31	138.10	127.70
T_3	Fenamidon + Mancozeb (3 gm/lt)	30.00(33.21)	19.00 (25.84)	24.50	114.19	123.91	119.05
T_4	Equation Pro (1 ml /lt)	31.00(33.83)	25.00 (30.00)	28.00	100.45	119.05	109.75
T_5	Cymaxanil +Mancozeb (3 gm/lt)	27.67(31.74)	22.67 (28.43)	25.17	112.60	118.35	115.48
T_6	Potassium Phosphonate(3 ml/lt)	58.67(49.99)	36.67 (37.27)	47.67	54.86	71.23	63.05
T_7	Propiconazole (1ml/lt)	100.00(90.00)	52.00(46.15)	76.00	50.00	71.53	60.76
T_8	Metalaxyl + Mancozeb (1.5 gm/lt)	71.00(57.42)	61.00(51.35)	66.00	77.48	88.99	83.23
	S.Em±	13.66	4.84				
	C.D. @0.05	41.43	14.70				

• Values in parenthesis are arcsine transformed values

was combined with Contaf 5EC (Hexaconazole 5%) as a best fungicide was reported by Siddique *et al.* (2016), Pranamika and Sikia(2013) and Johnson *et al.* (2000). The significantly lowest PDI was recorded in Ethaboxam 40 % SC (15.24%) followed by (Chlorothalonil- 33% + Metalaxyl 3.3% SC (19.41%), Azoxystrobin 23SC (22.05%) and Chlorothalonil 75% WP (25.56%) (Saidul Islam *et al.,* 2018). The use of protectant and systemic fungicides for managing late blight has perhaps been the most studied aspect of late blights management in temperate countries. In tropical Africa, the contact fungicide Dithane M 45 (Mancozeb 80% WP) and the systemic fungicide Ridomil MZ were widely used to control late blight of potato. However, the extensive use of Ridomil MZ has lead to development of resistant strains in the late blight pathogen (Runno, and Koppel, 2006). The present investigation confirms the previous findings that azoxystrobin 23% SC can be used effectively and as an alternative to this in the chemical rotation Fenamidon + Mancozeb (3 gm/lt) can be used effectively for the sustainable management of the potato blight disease.

Based on the results the azoxystrobin (23 per cent) (1ml/lt) found to be effective followed by fenamidon+mancozeb (3gm/lt) and cymaxanil+ mancozeb (3gm/lt) but propiconazole (1ml/lt) was found to be least effective in controlling the disease. The highest yield was obtained by the application of azoxystrobin (23 per cent) (1ml/lt), followed by fenamidon+mancozeb(3gm/lt).

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