International Journal of Sciences & Applied Research

www.ijsar.in

Evaluation of some fungicides against two fungal diseases of potato planted at different dates

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Abstract

A study was conducted to find out the effective management practice for fungal diseases of potato using fungicides and by alteration of date of planting. Three fungicidal treatment combinations are considered to manage the fungal diseases of potato. These fungicidal treatments were applied separately in three different dates of planting. Among the treatments Mancozeb 75%WP + Copper hydroxide 77%WP + Mancozeb 75%WP + Azoxystobin 23%SC + Azoxystobin 23%SC showed best result in respect of disease reduction of *Cercospora* leaf spot and late blight of potato in all the three dates of planting. This result is followed by Mancozeb 75%WP + Copper hydroxide 77%WP + Mancozeb 75%WP + (Cymoxanil 8% + Mancozeb 68%WP) + (Cymoxanil 8% + Mancozeb 68%WP), and Mancozeb 75%WP + Copper hydroxide 77%WP + Mancozeb 75%WP + (Pyraclostrobin 5% + Metiram 55%WG) + (Pyraclostrobin 5% + Metiram 55 %WG) in all planting dates. Besides, lowest disease intensity of *Cercospora* leaf spot and late blight of potato was found in case of first date of planting followed by second and third dates of planting in all the three treatment combinations. The result indicated early planting reduces some fungal diseases of potato.

Keywords: Potato, late blight, *Cercospora*, Mancozeb, Azoxystobin, Cymoxanil

Introduction

Potato (*Solanum tuberosum* L.) is one of the important commercial vegetable crops in India. Potato is a versatile food. Over a billion people consume potato, as a staple food in Europe and a principal vegetable in developing countries. It plays a pivotal role in farm economy. Its cultivation spread throughout the India and more than 80% of its area is concentrated in the indo-gangetic plains of which of about 74% area is in the states of Utter Pradesh, Bihar and West Bengal and 82% share in the total potato production. Among the potato growing states West Bengal got its second place after Utter Pradesh with their respective production of 84.823 and 114.583 lakh tones during the 2010-2011. Many disease causing agents *viz.*, viruses, fungus, bacteria, nematode, viroids and phytoplasmas are reported on potato. A number of fungal diseases like Late blight caused by *Phytophthora infestans*, Early blight caused by *Alternaria solani*, *Cercospora* leaf blotch

caused by *Cercospora concors* (Casp.), Powdery scab caused by Spongospora subterranean, Black scurf and stem canker, caused by *Rhizoctonia solani*, Sclerotinia rot is caused by *Sclerotinia sclerotiorum* etc. are known to attack Potato crop. Among the fungal diseases Late blight of potato caused by *Phytophthora infestans* (Mont.) de Bary, is one of the most important and devastating diseases affecting potato crops (*Solanum tuberosum* L.) in different countries of the world (Namanda *et al*., 2004). Late blight continues to be one of the main limiting factors for potato production in the world and if the disease is not controlled, losses can reach 100% (Ghorbani *et al*., 2004) and even with low infection levels, the crop may be unsuitable for storage. Therefore to manage the fungal diseases of potato the present experiment was conducted at U.B.K.V. Farm, Pundibari, Cooch Behar, West Bengal, India during 2012-13 cropping season.

Materials and methods

Field layout was prepared by using statistical design (RBD), where total plot size was 675 square metre (45m×15m) with consisting of total 32 plots, each of which 12 square metre (4m×3m). Planting operation has been done in three different respective dates, which are as follows- D1 - First date of planting (1st week of December), D2 - Second date of planting (2nd week of December) and D3 - Third date of planting (3rd week of December).Namely two diseases were scored- *Cercospora* leaf spot of potato and Late blight of potato. Disease scoring has been done with the help of disease scoring scale suggested by McKinney (1923)- "0"-No infection; 1<1% of area infected; 3 -1-10% of area infected; 5 - 11-25% of area infected; 7 -26-50% of area infected; 9 - More than 50% of area infected. Scoring was done at seven days interval. Percent of Disease Index (PDI) was calculated by using the formula given by the Wheeler (1969)-

$$PDI = \frac{\text{Sum of individual rating}}{\text{No of leaves assesed}} \times \frac{100}{\text{Mximum disease grade}}$$

Two groups of fungicides viz.contact fungicides,and systemic fungicides with different mode of action were taken into consideration. The Fungicides, Mancozeb 75% WP (Dithan-M-45) @ 2.0gm and Carbedazim 50% WP (Bavistin) @ 1.0 gm per Kg of seed were used for seed treatment. The contact fungicides-Mancozeb 75% WP (Dithan-M-45) (0.25%), copper hydroxide (kocide) 77% WP (0.2%) and Systemic fungicides Azoxystobin (Amistar) 23%SC (0.1%),Pyraclostrobin5%+Metiram55%WG (Cabriotop) (0.2%), Cymoxanil 8% + Mancozeb 68% (curzate) (0.2%) were used for foliar spray treatment. The followings are the treatment details**:**

T1= Mancozeb 75%WP + Copper hydroxide 77%WP + Mancozeb 75%WP + (Cymoxanil 8%+Mancozeb 68%WP) + (Cymoxanil 8% + Mancozeb 68%WP)

T2= Mancozeb 75%WP + Copper hydroxide 77%WP +Mancozeb 75%WP + Azoxystobin 23% SC+Azoxystobin23% SC

T3= Mancozeb 75%WP + Copper hydroxide 77%WP + Mancozeb 75%WP + (Pyraclostrobin5% + Metiram 55%WG) + (Pyraclostrobin 5%+Metiram 55 %WG)

T4=Control

Results and discussion

The result of this interaction effect on *Cercospora* leaf spot presented in Table 1. It is evident from the result that the treatment, T2 in interaction with all the three dates of planting showed minimum disease intensity which is significantly less than control. The other treatment T1 in interaction with different dates of planting also showed good result with significantly less PDI than control. The maximum reduction in disease in terms of PDI was found in the treatment combination T2D3 i.e., 34.17% reduction in PDI which is followed by T2D1 (32.62%) and T2D2 (30.87%). Most of the interaction effects resulted in significantly higher yield

than control. Maximum yield was obtained in T2D1 interaction with a yield of 26.61 Kg/plot (12sq m) with a projected yield of 22.18 ton/ha. The interaction effect of T1D1 also resulted in good yield of 25.19 Kg/plot with a projected yield of 20.99 ton/ha. The interaction between T2 and D2 resulted in yield of 23.31 Kg/plot with a projected yield of 19.43 ton/ha.

The effect of three different fungicidal treatment combinations and their different dates of planting were also studied on Late blight of potato. The interaction effects of these two parameters are presented in Table 1. The data presented in the Table reveals that maximum reduction in PDI over control was found in T2 followed by T1 and T3 respectively. In interaction with different date of planting, in case of T2D1 combination the percent reduction in PDI over control was 32.97%.The same in case of T2D2 and T2D3 are 36.19% and 38.50% respectively, T1D2 also showed good result with 31.48% reduction in PDI over control. In case of interaction between T3 and D3 also give good result with 29.52% reduction in PDI over control.

It is evident from the result that the combined effect of T1D1, T1D3, T2D1, T2D2, T2D3 and T3D3 showed significantly higher yield as compared to control. The result revealed that the interaction effect of T2 and D1 gives best result among the treatments with yield of 26.61 kg/plot (12 sq.m) with projected yield of 22.18 ton/hec. Among the other treatments T1D1 also give a very good result with a yield of 25.19 kg/plot with an estimated yield of 19.43 ton/ha.

A negative correlation of *Cercospora* leaf spot and late blight of potato with yield (r^2 = -0.740 and r^2 = -0.737, respectively) was found indicating that increase in disease severity results decrease in yield in case of both the diseases. This trend is clearly indicated in Fig. 1 and Fig. 2 for *Cercospora* leaf spot and late blight of potato, respectively. The yield reduction of Potato due to the severity of these two disease can be calculated from the regression equations [y=-0.157x+27.34 (R^2=0.740)] for *Cercospora* leaf spot and [y=-0.176x+26.77 (R^2=0.737) for late blight of potato.

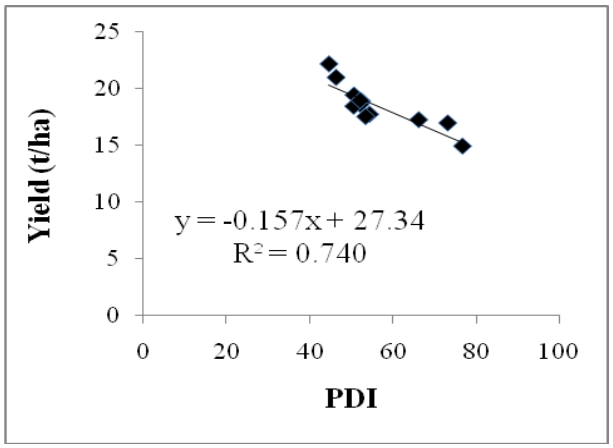

Fig 1: Correlation between *Cercospora* leaf spot disease severity and yield of potato.

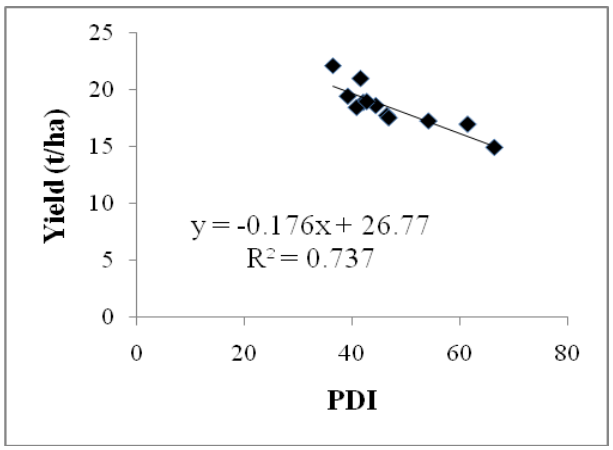

Fig 2: Correlation between late blight disease severity and yield of potato.

In the interaction effect between fungicidal treatment combinations and different dates of planting revealed best result with the fungicidal treatment combination having the fungicide Azoxystrobin 23%SC and first date of planting.

Table 1: Interaction effect between fungicidal treatment and date of planting on *Cercospora* leaf spot of Potato.

Treatment(T)× Date of planting(D)	*Cercospora* leaf spot		Late blight		Yield (Kg/Plot)	Yield (ton/ha)
	PDI	Reduction in PDI over control (%)	PDI	Reduction in PDI over control (%)		
T1D1	46.29 (42.57)	30.05	41.55	23.25	25.19	20.99
T1D2	52.44 (46.40)	28.34	42.07	31.48	22.67	18.89
T1D3	52.07 (46.19)	32.15	44.37	21.13	22.33	18.60
T2D1	44.59 (41.89)	32.62	36.29	32.97	26.61	22.18
T2D2	50.59 (45.34)	30.87	39.18	36.19	23.31	19.43
T2D3	50.52 (45.30)	34.17	40.81	38.50	22.13	18.44
T3D1	52.07 (46.19)	21.32	42.70	21.13	22.75	18.96
T3D2	54.37 (47.51)	25.70	46.44	24.36	21.27	17.73
T3D3	53.40 (46.96)	30.41	46.77	29.52	21.04	17.53
D1(Control)	66.18 (54.46)	-	54.14	-	20.70	17.25
D2(control)	73.18 (58.81)	-	61.40	-	20.35	16.96
D3(control)	76.74 (61.17)	-	66.36	-	17.90	14.92
SEm±	**0.942**		**1.781**		**0.972**	
CD (0.05)	**2.763**		**5.223**		**2.851**	

*The data within the parentheses are angular transformed value

It is clear that the fungicidal treatments and early planting give good result showing less disease intensity, as discussed earlier. This is found true against both the diseases Cercospora leaf spot and Late blight of potato, because similar trend have been found against both the diseases. Therefore, combination of early planting and effective fungicides may be a good choice to manage the diseases. Early planting of potato has been good against potato disease particularly Late blight (Forbes *et al.*2008; Arora *et al,.*1999; Sekhon and Sokhi, 1999). Besides, some fungicides have been found to show good result in reduction of Late blight disease (Sharma and Saikia, 2013; Ghazanfar *et al*., 2010). The present result is also in line with these previous findings.

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