

EFFECTIVE MANAGEMENT STRATEGIES AGAINST LATE BLIGHT OF POTATO

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ABSTRACT

A field experiment was conducted during 2012-13 and 2013-14 crop season to find out the most effective strategies for management of late blight of potato. It was observed that prophylactic spray with mancozeb @ 0.2% followed by fenamidone + mancozeb @ 0.3% as 2nd spray at the onset of the disease followed by mancozeb @ 0.2% as 3rd spray seven days after application of the 2nd spray followed by one more spray with fenamidone+mancozeb @ 0.3% as 4th spray seven days after application of 3rd spray exhibited best management of late blight of potato in terms of percent reduction of disease over control which was 83.64 and 84.79% in 2012-13 and 2013-14 crop season, respectively. The total tuber yield was also highest in this treatment showing 25.84 and 26.78 t ha⁻¹ during 2012-13 and 2013-14 crop season, respectively.

Keywords: Effective management, fenamidone+ mancozeb, late blight of potato.

INTRODUCTION

Late blight of potato is one of the most dreaded diseases wherever potato is grown. During mid 1800, the disease caused wide-spread crop failure throughout the Northern Europe including Ireland where it was responsible for the famous Irish Famine in 1845 (Elansky et al., 2001). In West Bengal the disease was first noticed in Darjeeling district in 1883. In the plains, the disease was first noticed in Hooghly districts during 1898-1900.

Today the disease is a recurring feature in plains of West Bengal. It occurs in mild to moderate form every year but assumes severe form and develop epidemic only in occasions. Yield losses in the plains have been estimated around 10-75% (Dutt, 1979). Management of the disease is a great challenge to the plant pathologists

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all over the world. This is due to the unique capacity of pathogen to cause cell death of the host and this happens so fast that within 2-4 days the entire crop collapse under favourable weather condition.

The resistant variety is the only cheapest and environment friendly approach to combat the disease but the pathogen is highly variable and changes itself with a slight change in the environment. The host genotype resistance in most of the varieties is broken within few years of their cultivation. Therefore, the most effective alternative is the need based use of chemical fungicide for management of the disease (Singh et al., 2003).

Among the fungicides the most effective is systemic one. But indiscriminate use of fungicides also has adverse effect on resistance as the pathogen develops resistance against the systemic fungicides. Therefore, it is not advisable to use only one or two systemic fungicides for long-term basis, instead the fungicides should be changed after few years and newer molecules should be introduced in its place to avoid development of resistance in the pathogen. Keeping these views in mind the present investigation was carried out to develop an effective spray schedule for the most effective management of the disease.

MATERIALS AND METHODS

The experiment was conducted at Adisaptagram Block seed Farm, Hooghly, West Bengal during 2012-13 and 2013-14 crop seasons. The planting was done in November each year. Two varieties like Kufri Chandramukhi (V_1) and Kufri Jyoti (V_2) were used for this experiment. The experiment was laid out following a randomized block design with 4 replications and 6 treatments. The unit plot size was 5m × 2m and potato seeds were planted in line maintaining 60cmx20cm spacings. Prophylactic foliar sprays were applied just at the time of canopy closure i.e. 45-50 days after planting according to the details of spray schedules shown below.

- T_1 = Spray with mancozeb @ 0.2% followed by 2 more spray with mancozeb @ 0.2% at weekly intervals starting from onset of the disease.
- T_2 = Spray with mancozeb @ 0.2% followed by 3 more sprays with mancozeb @ 0.2% at weekly intervals starting from onset of the disease.
- T_3 = Spray with mancozeb @ 0.2% followed by cymoxanil + mancozeb @ 0.3% as 2nd spray at the onset of the disease followed by mancozeb @ 0.2% as 3rd spray seven days after the application of 2nd spray followed by one more with cymoxanil + mancozeb @ 0.3% as 4th spray seven days after application of 3rd spray.
- T_4 = Spray with mancozeb @ 0.2% followed by fenamidone + mancozeb @ 0.3% as 2nd spray at the onset of the disease followed by mancozeb @ 0.2% as 3rd seven days after the 2nd spray followed by one more spray with fenamidone + mancozeb 0.3% as 4th spray seven days after application of 3rd spray.

T₅ = Spray with mancozeb @ 0.2% followed by dimethomorph + mancozeb @ 0.3% as 2nd spray at the onset of the disease followed by one more spray with mancozeb @ 0.2% as 3rd spray seven days after the 2nd spray followed by one more spray with dimethomorph + mancozeb @ 0.3% as 4th spray seven days after application of 3rd spray.

T₆ = Control (no fungicidal spray)

In each plot 50 plants were selected randomly and in each plant one top leaf, one middle leaf and one lower leaf were selected for estimation of severity of the disease. The data on severity of the disease was recorded before every spray following 0-9 scale as developed by Malcolimson (1976) based. The details of which are shown below.

Percent leaf area infected (%)	Score
0	0
1-9	1
10	2
11-25	3
26-40	4
41-60	5
61-70	6
71-80	7
81-90	8
91-100	9

Thereafter, the percent disease index (PDI) was calculated following the formula developed by McKinney (1923)

$$\text{PDI} = \frac{\text{Sum of all numerical ratings}}{\text{Total No. of leaves Examined} \times \text{Maximum Grade}} \times 100$$

RESULTS AND DISCUSSION

At 7 days of first appearance of the disease, visible symptoms of late blight appeared only under control (T₆) where the PDI was 18.42 in variety Kufri Chandramukhi (V₁) and 17.90 in variety Kufri Jyoti (V₂). In V₁, the lowest disease severity (PDI) was recorded from T₄ followed by T₅, T₃, T₂ and T₁ at 14, 21 and 28 days after first spray. At 28 days after first appearance of the disease, the reduction in PDI was 76.07, 77.88, 80.06, 82.98% and 83.64 over control (V₁T₆). Similarly, the lowest PDI was recorded from treatment T₄ followed by T₅, T₁, T₃ and T₂ in V₂ at 14, 21 and at 28 days after first appearance of the disease. At 28 days after first

appearance of the disease the reduction in PDI was 83.35, 80.72, 78.74, 78.46 and 78.37% under T₄, T₅, T₁, T₃, and T₂, respectively over control in V₂ (Table 1).

Table 1. Efficacy of different fungicides against late blight of potato during 2012-13 crop season.

Treatments	Percent disease severity at days after first spray				% disease reduction over control	Yield t/ha
	7	14	21	28		
V ₁ T ₁ *		9.45 (18.39)**	11.09 (19.90)	13.50 (21.97)	76.07	22.56
V ₁ T ₂		8.97 (17.92)	10.60 (19.46)	12.48 (21.12)	77.88	21.62
V ₁ T ₃		8.50 (17.46)	9.95 (18.86)	11.25 (20.05)	80.06	23.89
V ₁ T ₄		7.04 (15.94)	8.49 (17.45)	9.23 (18.18)	83.64	25.84
V ₁ T ₅		7.65 (16.59)	8.64 (17.60)	9.60 (18.53)	82.98	24.89
V ₁ T ₆	18.42	34.05 (36.00)	48.45 (44.40)	56.42 (48.98)	-	16.50
V ₂ T ₁		8.65 (17.61)	9.64 (18.57)	11.30 (20.09)	78.74	30.34
V ₂ T ₂		8.97 (17.92)	10.14 (19.04)	11.50 (20.27)	78.37	28.51
V ₂ T ₃		8.32 (17.28)	10.94 (19.77)	11.45 (20.22)	78.46	27.12
V ₂ T ₄		7.03 (15.93)	8.41 (17.37)	8.85 (17.80)	83.35	27.56
V ₂ T ₅		7.49 (16.42)	9.57 (18.50)	10.25 (19.14)	80.72	26.62
V ₂ T ₆	17.90	32.76 (35.22)	45.23 (42.55)	53.17 (47.10)	-	18.98
SEm (±)		0.66	0.59	0.74		2.54
CD (P=0.05)		1.37	1.23	1.53		5.28

* Abbreviations of V₁&V₂ and T₁-T₆ have mentioned in Section Materials and Methods

** Figures within parentheses are angular transformed values.

In variety V_1 , the highest total tuber yield was obtained with the treatment T_4 followed by T_5 , T_3 , T_1 and T_2 showing the yield of 25.84, 24.89, 23.89, 22.56 and 21.62 t ha⁻¹, respectively compared to control. In V_2 , the highest tuber yield was recorded from T_1 followed by T_2 , T_4 , T_3 , and T_5 . Per hectare tuber yield was 30.34, 28.51, 27.56, 27.12 and 26.62 t, respectively. In both varieties, the lowest yield of 16.50 t was harvested from V_1T_6 and 18.98 t from V_2T_6 (Table 1).

Table 2. Efficacy of different fungicides against late blight of potato during 2013-14 crop season

Treatments	Percent disease severity at days after first spray				% disease reduction over control	Yield t/ha
	7	14	21	28		
$V_1T_1^*$		10.48 (18.89)**	12.17 (20.43)	15.01 (22.81)	77.84	23.59
V_1T_2		9.50 (17.95)	11.89 (20.17)	14.29 (22.22)	78.91	24.38
V_1T_3		8.79 (17.25)	10.64 (19.05)	12.77 (20.94)	81.15	25.49
V_1T_4		7.91 (16.33)	8.91 (17.38)	10.30 (18.72)	84.79	26.78
V_1T_5		8.29 (16.74)	9.68 (18.14)	11.71 (20.01)	82.71	26.28
V_1T_6	21.58	37.08 (37.53)	53.11 (46.81)	67.76 (55.44)	-	17.49
V_2T_1		10.07 (18.50)	11.62 (19.94)	14.34 (22.26)	77.43	24.31
V_2T_2		9.01 (17.48)	11.08 (19.45)	13.78 (21.80)	78.31	25.97
V_2T_3		8.61 (17.07)	10.38 (18.80)	12.26 (20.50)	80.71	26.88
V_2T_4		7.45 (15.85)	8.50 (16.96)	10.13 (18.56)	84.06	28.69
V_2T_5		7.83 (16.26)	9.03 (17.50)	11.18 (19.54)	82.41	27.49
V_2T_6	20.01	33.58 (35.43)	50.47 (45.30)	63.56 (52.90)	-	19.67
SEm (\pm)		0.35	0.39	0.59		0.74
CD (P=0.05)		0.72	0.80	1.21		1.50

*Abbreviations of V_1 & V_2 and T_1 - T_6 have mentioned in Section Materials and Methods

** Figures within parentheses are angular transformed values.

The results of 2013-14 crop season are presented in table 2. The findings reveal that in variety K. Chandramukhi (V_1) the minimum PDI value was obtained with the treatment T_4 (10.30%) followed by treatment T_5 (11.71%) and T_3 . The highest PDI was recorded from control (V_1T_6). The percent reduction of the disease over control was 84.79 and 82.71% in treatment V_1T_4 and V_1T_5 respectively at 28 days first appearance of the disease. The highest total tuber yield of 26.78 t ha^{-1} was recorded in treatment V_1T_4 followed by treatment V_1T_5 .

In variety K. Joyti (V_2) the lowest PDI was also observed in treatment V_2T_4 (10.13) followed by treatment V_2T_5 where percent disease severity was 11.18. The highest PDI was found in treatment (V_2T_6) where percent disease severity was 63.56% at 28 days after first appearance of the disease. The treatment V_2T_4 and V_2T_5 showed 84.06 and 82.41% reduction in PDI, respectively. The highest total tuber yield of 28.69 t ha^{-1} was also obtained with the treatment T_4 in variety V_2 followed by treatment T_5 where total tuber yield was 27.49 t ha^{-1} .

The findings found in the present investigation are in agreement with the findings of De and Sengupta, 1988 and 1991 who observed that mancozeb and combined product of systemic and contact fungicide may have synergistic effect against *P. infestans*. Baider and Cohen (2003) also reported that combination of mancozeb with beta amino butyric acid (BABA) has synergistic effect against *P. infestans* in potato and tomato than either of them alone. Chakraborty and Majumder (2012) also observed that late blight can effectively be managed by adopting prophylactic spray with mancozeb @ 0.25% followed by cymoxamil + mancozeb @ 0.3% at the onset of the disease followed by mancozeb @ 0.25% seven days after application of systemic fungicide.

CONCLUSION

Based on findings of the present experiment it may be concluded that the late blight of potato can effectively be managed by applying prophylactic spray (just at the time of canopy closure) with mancozeb @ 0.2% followed by fenamidone + mancozeb @ 0.3% as 2nd spray at the onset of the disease followed by mancozeb @ 0.2% as 3rd spray seven days after the application of 2nd spray followed by fenamidone + mancozeb @ 0.3% as 4th spray seven days after the application of 3rd spray.

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