Fungicide spray schedule for economical management of potato late blight

SHAILBALA and V. S. PUNDHIR
Department of Plant Pathology, College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar-263145 (U.S.Nagar, Uttarakhand)

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Late blight of potato is caused by *Phytopthora infestans* (Mont.) de Bary is responsible for considerable economic losses. The disease appears regularly in epiphytotic proportion in the hilly regions of the country and cause considerable reduction in yield and quality. Most of the recommended fungicides often fail to provide adequate control if not applied at appropriate time. Moreover, there is high risk of development of fungal races resistant to systemic fungicides. Josepovits and Dobrevalszky (1985) reported that the use of mixture of fungicides with different mode of action as the best strategy to delay the buildup of resistance. Application of alternate sprays of systemic fungicides has also been reported to restrict the development of resistant strains of pathogen (Skylakakis, 1981). In the present communication, potential to control late blight have been studied with a view to develop an effective and safe spray schedule for management of this disease.

A field experiments were conducted for consecutive two years (2003-05) during *rabi* season at Vegetable Research Centre (VRC), Pantnagar, which is situated in Tarai belt at the foothills of Shivalic range Himalayas at 29^0N latitude and 79.73^0E longitude and at an altitude of 243.84 m above mean sea level. Three cultivars of potato namely Kufri Bahar, K. Sutlej and K. Jawahar were planted in the last week of October in view of exposing the crop to highly congenial environment for disease development. The experiment was laid out in randomized block design with five treatments and three replications. The treatments comprised of sprays of fungicidal combinations namely ridomil MZ @0.2%+ mancozeb @ 0.2%, mancozeb @ 0.2% + ridomil MZ @0.2%, mancozeb @ 0.2%, blitox-50@0.3%, kocide @0.3% and the control (In T_1 treatment, I^{st} spray of ridomil MZ @ 0.2% was followed by II^{nd} spray of mancozeb at 10 days interval and in T_2 treatment, I^{st} spray of mancozeb was followed by II^{nd} spray of ridomil MZ at 7 day interval). The plot size was 4.20×2.40 m^2. All the fungicides were sprayed just before the appearance of late blight. Disease severity was recorded at weekly interval (Anonymous, 1947). Tuber yield was recorded at the time of harvesting.

Effect of fungicides on disease severity: During 2003-04 cropping season, maximum disease severity (99.60%) was obtained in control plots of potato cultivar K. Bahar and all the test treatments were significantly superior to control in reducing disease while no disease was recorded in plots of potato cultivar K. Sutlej and K. Jawahar.

During 2004-05 cropping season in case of potato cultivar K. Bahar, minimum disease severity (1.33%) was recorded from mancozeb sprayed plot followed by ridomil MZ + mancozeb sprayed plots (1.93 %) while control plot showed maximum disease severity (100 %). In case of potato cultivar K. Sutlej, maximum disease severity was recorded in control plot as in above case; while minimum disease severity (0.66%) was recorded in ridomil MZ + mancozeb sprayed plot followed by mancozeb sprayed plot (1%). Control plot showed 90.33% disease severity. Similar pattern of disease was seen in case of potato cultivar K. Jawahar as above by potato cultivar K. Bahar. Kocide proved as least effective treatment. Sharma (1992**)** found that metalaxyl + ziram was the best treatment (0.3 per cent disease intensity) followed by metalaxyl + mancozeb, oxadixyl + copper oxychloride and oxadixyl + mancozeb where mean disease intensity were 0.53 per cent, 0.83 per cent and 1.52 per cent respectively as compared to 12.39 per cent in unsprayed plot.

Table 1: Effect of fungicidal scheduling on disease severity of late blight recorded at weekly interval during 2003 – 04 cropping season

Cultivar	Treatment	Late blight severity (%)						
		23/12	30/12	6/01	11/01	19/01	27/01	3/02
K Bahar	Ridomil MZ-72 + Mancozeb	0.10 (1.77)	1.0 (5.61)	1.10 (6.00)	1.16 (6.09)	1.16 (6.09)	1.16 (6.09)	2.33 (8.55)
	Mancozeb + Ridomil MZ-72	0.10 (1.77)	1.0 (5.61)	1.10 (6.00)	1.16 (6.09)	1.16 (6.09)	1.16 (6.09)	2.33 (8.55)
	Mancozeb	0.10 (1.77)	1.0 (5.61)	1.10 (6.00)	1.16 (6.09)	1.16 (6.09)	1.16 (6.09)	2.33 (8.55)
	Blitox-50	0.10 (1.77)	1.0 (5.61)	1.10 (6.00)	1.16 (6.09)	1.16 (6.09)	1.16 (6.09)	2.33 (8.55)
	Kocide	0.10 (1.77)	1.0 (5.61)	1.16 (6.09)	1.16 (6.09)	1.16 (6.09)	2.33 (8.55)	2.33 (8.55)
	Control	1.10 (5.53)	6.30 (13.09)	17.66 (24.85)	35.50 (36.22)	68.11 (56.41)	90.33 (72.23)	99.66 (87.31)
	CD1 (cultivar)	0.54	1.17	0.66	1.16	1.22	1.20	1.12
	CD2 (treatment)	0.70	1.56	0.85	1.49	1.57	1.55	1.57
	CD3 (interaction)	1.12	2.63	1.48	2.59	2.72	2.87	2.72

Effect of fungicides on tuber yield: During 2003-04 cropping season, potato cultivar K. Bahar recorded maximum potato yield (320.27 q/ha.) with the sprays of ridomil MZ + mancozeb followed by mancozeb + ridomil MZ (310.13 q/ha.) as compared to control (201.38 q/ha.). In case of K. Sutlej, similar pattern was seen but control plot showed 290.27q/ha potato yield. Similar pattern was obtained in case of potato cultivar K. Jawahar where control plot showed 295.36 q/ha potato tuber yield. During cropping season 2004-05, similar pattern was obtained.

Economics of fungicide spray schedule: The economics of application of fungicide spray schedule at current market price indicated that three sprays of mancozeb @ 0.2% gave highest benefit cost ratio in all the potato cultivars in both cropping seasons followed by ridomil MZ @ 0.2%+ mancozeb @ 0.2%. Three sprays of kocide were least effective in terms of B-C ratio. These results indicate the critical importance of fungicidal spray schedule to prevent loss in yield. Shtienberg *et al.* (1994) developed fungicide schedules for both susceptible and resistant cultivar and reported that one spray of each metalaxyl based fungicide and mancozeb are required for controlling the disease on susceptible cultivars where as one spray of mancozeb could manage the disease on resistant cultivar. Sharma (1992) also reported that fungicidal mixture having metalaxyl and oxadixyl as systemic component gave effective control of late blight in the plains of India. Singh (1996) suggested that two sprays of ridomil MZ @ 0.25 per cent at fifteen days interval or four sprays of mancozeb @ 0.2 per cent at weekly interval was effective treatment for management of disease.

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Table 2: Effect of fungicide scheduling on tuber yield and benefit cost ratio

Cultivars	Treatment	2003-04			2004-05		
		Yield (q/ha)	Yield loss (q/ha)	B: C Ratio	Yield (q/ha)	Yield loss (q/ha)	B: C Ratio
K. Bahar	Ridomil MZ-72 + Mancozeb	320.27	118.89	8.80	375.83	170.28	12.61
	Mancozeb + Ridomil MZ-72	310.13	108.75	8.05	337.5	131.95	9.77
	Mancozeb	303.23	101.85	13.01	311.11	105.56	13.47
	Blitox-50	298.61	97.23	7.91	302.22	96.67	7.86
	Kocide	286.66	85.28	6.39	284.44	78.89	2.92
	Control	201.38	-	-	205.55	-	-
K. Sutlej	Ridomil MZ-72 + Mancozeb	362.5	72.23	5.35	382.36	137.92	10.23
	Mancozeb + Ridomil MZ-72	348.83	58.56	4.34	372.63	128.19	9.49
	Mancozeb	326.86	35.99	4.67	346.25	101.81	12.99
	Blitox-50	321.29	31.02	2.52	291.52	47.08	1.39
	Kocide	310.69	20.42	1.53	277.77	33.33	2.49
	Control	290.27	-	-	244.44	-	-
K. Jawahar	Ridomil MZ-72 + Mancozeb	370.83	75.47	5.59	345.27	130.55	9.67
	Mancozeb + Ridomil MZ-72	361.11	65.75	4.87	319.44	104.72	7.75
	Mancozeb	349.51	54.15	6.92	310.13	95.41	12.18
	Blitox-50	338.33	42.97	3.49	307.36	92.64	7.53
	Kocide	314.72	19.36	1.45	296.25	81.53	6.12
	Control	295.36	-	-	214.72	-	-

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