Evaluation of fungicides against late blight (*Phytophthora infestans*) on susceptible and moderately resistant potato cultivars

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Late blight caused by oomycete pathogen *Phytophthora infestans* (Mont.) de Bary, is one of the most destructive diseases of potato and results in yield losses up to 95% in epidemic conditions. The pathogen is polycyclic in nature and completes many cycles in a crop season. Management strategies for its effective control include use of host resistance, chemicals, forecasting, sanitation and even disease escape (2, 10). Although the best strategies to combat this menace is to breed for host resistance, yet the experience so far has shown that resistance in potato varieties break down within a decade. Therefore, only suitable alternative left over is use of fungicides. However, the pathogen has shown a remarkable capacity for change with respect to host genotype and fungicides. As a result, disease control requires regular application of fungicides at high rates and short intervals throughout the growing season. It is therefore, important to enhance host resistance with fungicides. The use of cultivars with durable resistance combined with scheduled applications of protective fungicides has been reported as useful for managing late blight, as well as for other diseases. Regarding effectiveness of mixture of fungicides and their rotation strategies, experimental data are limited (4). In the present study different treatment combinations were assessed on two potato varieties having different level of resistance to know their efficacy in the management of late blight.

The experiments were conducted at the CPRI campus, Modipuram, Meerut (29.1°N, 77.92°E, 300 m amsl) during 2010-11 to 2012-13 cropping seasons. Two varieties namely, Kufri Bahar (susceptible) and K. Anand (moderately resistant) were used in 2010-2011 but subsequently K. Anand was replaced with K. Badshah as it showed high disease incidence during tested period. The varieties were planted in the second week of November each year in a randomized block design in a plot size of 3x3 m² at a distance of 60 (row to row) × 20 cm (plant to plant). The standard agronomic practices were followed to raise the crop. Six treatment combinations of systemic and non-systemic fungicides along with a control viz. T1: Mancozeb (0.2%, before appearance of late blight) followed by metalaxyl + mancozeb (0.25%, at onset of late blight) and cymoxanil + mancozeb (0.3%) after 7-10 days of second spray; T2: Chlorothalonil (0.2%, before appearance of late blight) followed by cymoxanil + mancozeb (0.3%, at onset of late blight) and metalaxyl + mancozeb (0.25%) after 7-10 days of second spray; T3: Mancozeb (0.2%, before appearance of late blight) followed by cymoxanil + mancozeb (0.3%, at onset of late blight) and fenamidone + mancozeb (0.2%) after 7-10 days of second spray; T4: Mancozeb (0.2%, at onset of late blight) followed by metalaxyl + mancozeb (0.25%) after 7-10 days of first spray and cymoxanil + mancozeb (0.3%) after 7-10 days of second spray; T5: Chlorothalonil (0.2%, at onset of late blight) followed by cymoxanil + mancozeb (0.3%) after 7-10 days of first spray and metalaxyl + mancozeb (0.25%) after 7-10 days of second spray; T6: Mancozeb (0.2%, at onset of late blight) followed by cymoxanil + mancozeb (0.3%) after 7-10 days of first spray and fenamidone + mancozeb (0.2%) after 7-10 days of second spray; and T7: Control (water spray). In all, three sprays i.e. one contact and two systemic fungicides were given and each treatment was replicated thrice. Disease severity was recorded before each spray and last reading was taken after 10 days of final spray. Area under the disease progress curve (AUDPC) was calculated according to the method of Shaner and Finney (9) while relative area under the disease progress curve (rAUDPC) was calculated (8). Data on percentage disease control and tuber yield were also recorded at the time of harvesting. The experimental data were analyzed with the help of IRRISTAT software (version 4.4.20030719).

The appearance of late blight was delayed by 1 to 3 days in susceptible and 2 to 4 days in moderately resistant cultivars in treatments T4, T5, T6 whereas 3 to 5 days and 2 to 7 days in T1, T2 and T3 treatments, respectively over control as compared to T7. Results revealed that the minimum terminal disease severity (45%) was recorded in treatment T2 followed by T3 (55%) and T1 (61.67%) on cv. K. Bahar as against 93% in T7 (control). Similar trend was observed on cv. K. Anand (Table 1). No significant difference was observed in...
terminal disease severity in the treatments on both the cultivars, as congenial environmental conditions persisted for longer duration. Similarly, the lowest AUDPC (157.5 and 171.5), rAUDPC (0.23 and 0.25) and the highest tuber yield (44.66 and 42.89 t/ha) were observed in T2 followed by T3 and T1 on both the cultivars. When treatment combinations were evaluated in subsequent years on cv. K. Badshah, same treatment combinations were found effective (Table 2). However, disease severity was low in moderately resistant cultivar (K. Badshah) in comparison to susceptible K. Bahar. During these experimentation years late blight appeared late in the season as a result no adverse effect on tuber bulking was recorded, hence, non-significant effect on yield of K. Bahar was observed. Prophylactic sprays of chlorothalonil/mancozeb followed by systemic/trans
Laminar fungicides were found effective than post symptom sprays. Chakraborty and Mazumdar (5) also reported that the severe late blight can be effectively managed with prophylactic spray of mancozeb @0.25% followed by cymoxanil + mancozeb or dimethomorph + mancozeb @0.3% at the onset of disease and one more spray of mancozeb @0.25% seven days after application of systemic fungicides. Bhat et al. (3) reported that the mancozeb (1 spray) followed by cymoxanil+mancozeb (3 spray) was effective on cv. K. Bahar. Earlier spray schedules were one prophylactic spray using contact fungicides followed by systemic fungicides and one more spray of either same contact or same systemic fungicides. After introduction of metalaxyl, within three years metalaxyl resistant isolates were detected on field grown potatoes in Ireland, The Netherlands and Switzerland (7). Due to development of resistance to fungicides, a new fungicide, Victory 72 WP was first used in controlling late blight of potato and tomato in West Shoa of Ethiopia (1). It has been reported from European country that the same fungicide should not be applied more than two sequential applications. The systemic fungicides have better persistence on the host surface and are being used as mixture with contact fungicides against late blight so as to avoid development of resistance in pathogen (6). But in present study, it is a unique combination of treatments that the post spray (curative spray) of same mode of action fungicide was not taken, keeping in view the sensitivity of P. infestans to develop fungicides resistance. This will be useful to minimize the yield losses due to late blight and assist in reducing development of resistance against fungicides in pathogen.

REFERENCES

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