

Potato late blight and weather relationships under different sowing dates and wetness conditions

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ABSTRACT

A field study was conducted on incidence and intensity of late blight of potato (var. Kufri Chandramukhi) during autumn 1999-2000 under three dates of planting (D1-30 Sept; D2-21 Oct and D3-10 Nov.) and four wetness/chemical treatments, viz, (i) artificial inoculation under natural wetness (I); (ii) chemical control under natural wetness (C); (iii) artificial inoculation under additional wetness (IW); and (iv) chemical control under additional wetness (CW). Additional wetness was created by-sprinkler water spray while chemical control was achieved by fungicide spray. D1 planting experienced a mean temperature of 16.9-17.5°C and RH of 56-67% upto 10 days after inoculation and escaped the disease. The intensity of disease increased with delay in planting and was greater under additional wetness (IW) compared to natural wetness (I) conditions in both D2 and D3 dates of planting.

Key words: Late blight of potato, wetness, planting date, weather.

Potato (*Solanum tuberosum* L.) crop is subject to various biotic and abiotic stresses including weather, disease and insect-pests, which influence its growth, development and tuber yield. The late blight of potato caused by *Phytophthora infestans* (montagne) de-Bary appears in varied intensity in some seasons whereas in others it does not appear at all. This indicates that variation of weather from season to season affects the occurrence/non-occurrence of this disease. Low temperature and high relative humidity prevailing within the plant canopy favours the disease development (Phukan, 1995). Temperature is the major factor, which affects the development and spread of late blight of potato. Bombawale *et al.*, (1991)

reported that temperature duration more than 20°C consistently correlated negatively with disease progress. Harrison and Lowe, (1989) reported that the temperature for infection varies from 5-25°C with an optimum around 15°C and maximum growth of hyphae at 20°C.

Humidity also has a profound effect on development of potato blight (Minogue and Fry, 1981). They indicated that the original sporangia arriving in a potato crop are relatively dry and would need to imbibe water before they could germinate. Rain, drizzle, fog, mist and dew formation result in wet phase which increase the humidity of the air within and just above the crop canopy (Harrison, 1992). Bombawale *et*

al., (1991) also concluded that wet conditions after rain or dew favour the late blight epidemics. Not much information is available in Punjab on weather-late blight relations. Hence a study was planned to evaluate the role of sowing time and wetness period on incidence and intensity of late blight potato.

MATERIALS AND METHODS

A field experiment was conducted using potato variety Kufri Chandramukhi on a loamy sand soil at Ludhiana (Punjab) during Rabi 1999-2000. The experiment included three dates of planting namely, 30 Sept, (D1); 21 Oct.(D2); and 10 Nov. (D3) and four wetness/chemical treatments viz. I) Artificial inoculation under natural wetness (I); ii) Chemical control under natural wetness (C); iii) artificial inoculation under additional wetness (IW); and iv) Chemical control under additional wetness (CW). The crop was sown at 60X20 cm spacing and received fertilizer @ 120 kg N ha⁻¹, 50kg P₂O₅ ha⁻¹ and 120 kg K₂O ha⁻¹. Half dose of nitrogen and full dose of P and K were applied at the time of planting while remaining half of nitrogen was applied at the time of earthing up 45 days after planting (DAP).

Late blight sporangial inoculum was prepared in laboratory from sporulating leaves with its concentration adjusted to 5X10⁴ sporangia per ml of water. Artificial inoculation was carried out on a single plant located in the center of each artificial inoculated treatment (I and IW) plot. The inoculum was sprayed in the evening at 1800

hrs with an automizer after which the plant was covered with wet polythene for overnight. First inoculation was done on 25-11-1999 to D1 at 57 DAP and D2 at 36 DAP. Second inoculation was done on 08-12-1999 to D1 at 70 DAP and D2 at 49 DAP. Third inoculation was done on 14-12-1999 to D2 at 55 DAP and D3 at 35 DAP.

The IW and CW plots with additional wetness received sprinkler water applied on alternate day using the rotating sprinkler placed in the center of the plot. The additional wetness was started with the appearance of leaves in D1, D2 and D3 plots at 43, 30 and 28 DAP respectively. The C and CW plots were given two sprays with Dithane M-45 at weekly interval followed by Ridomil MZ spray at 10 days interval for chemical control of the late blight. Disease incidence and intensity were recorded in all treatment plots. Incidence was recorded as the date of start of disease on any of the 100 randomly selected plants in a plot. The intensity of the disease was recorded in %age using 0-9 disease rating scale (Tomar, 2000) as shown below:

Scale	% age of area diseased	Scale	% age of area diseased
0	nil	5	31-40
1	1-5	6	41-55
2	6-10	7	56-70
3	11-20	8	71-85
4	21-30	9	>85

Leaf wetness duration was

Table 1: Effect of cumulative wetness under natural and additional wetness conditions on intensity of late blight of potato crop planted on 21 Oct. 1999 (D2).

DAP	Cumulative wetness hours		Disease intensity (%)			
	Natural wetness	Additional wetness	I	C	IW	CW
42	0	0	0	0	0	0
49	95	112	0	0	0	0
56	194	262	0	0	0	0
63	286	397	0	0	0	0
70	399	528	0	0	0	0
77	506	656	4	0	7	0
84	586.5	757	7	0	35	0
91	678	859	15	0	48	0
98	770	964	15	0	48	0

Table 2: Effect of cumulative wetness under natural and additional wetness conditions on intensity of late blight of potato crop planted on 10 November, 1999 (D3)

DAP	Cumulative wetness hours		Disease intensity (%)			
	Natural wetness	Additional wetness	I	C	IW	CW
28	95	112	0	0	0	0
35	194	262	0	0	0	0
42	286	397	0	0	0	0
49	399	528	0	0	0	0
56	506	656	1	0	4	0
63	586	757	2	0	5	0
70	678	859	3	0	16	0
77	770	964	15	0	48	2
84	864	1073	34	10	90	19
91	976	1197	90	17	100	29

I : Inoculated under natural wetness

IW : Inoculated under additional wetness

C : Chemical control under natural wetness

CW : Chemical control under additional wetness

recorded using portable leaf wetness recorder (Belfort Inst. Co.) at mid-canopy height in two plots representing additional wetness and natural wetness conditions. Weather data were obtained from agrometeorological observatory located on the research farm and within 50 m from the experimental field.

RESULTS AND DISCUSSION

Effect of sowing dates

Late blight of potato did not appear on D1 crop at all, Ahn-Jaehoon *et al.*, (1998) reported that if the temperature is $>12^{\circ}\text{C}$ and RH about 79% for five consecutive

days the disease is expected to occur after one to two weeks. Normally early sown crop escapes the late blight. Arora *et al.*, (1999) also reported that potato crop planted around 30th of Sept. either escaped late blight completely or suffered minimum damage.

Late blight started on D2 treatment after third inoculation (55 DAP) and on D3 crop after first inoculation (35 DAP) when the environmental conditions became favorable. The weather became foggy about three days after inoculation to D2 and D3 on 14-12-1999. Sunshine hours after inoculation of 14-12-1999. Mizubuti *et al.*, (2000) reported that exposure of sporangia for three hours on a sunny day drastically reduced germination regardless of time of the day of exposure.

The disease developed in D2 at 64 DAP (bulking stage) and reached 50% disease intensity near maturity of the crop under additional wetness treatment. The disease developed in D3 at 45 DAP (start of tuber growth) and reached 100% disease intensity near maturity of crop under the additional wetness treatment. Fry and Apple (1986) reported that epidemics of potato late blight progressed more slowly in intermediate age plants than in older plants because potato crop at maturity stage becomes more susceptible to the disease.

Effect of wetness

The additional wetness played greater role in proliferation of the disease.

The disease intensity increased with cumulative wetness hours. It reached 7% under natural wetness and 35% under additional wetness in D2 at 84 DAP while at 91 DAP the corresponding values reached 15% and 48% respectively (Table 1). The disease intensity reached 34% under natural wetness and 90% under additional wetness in D3 at 84 DAP while the corresponding values at 91 DAP were 90% and 100% respectively (Table 2).

The results revealed that the disease intensity increased with delay in planting under both natural and additional wetness treatments. Further an increase in wetness duration resulted in an increase in the intensity of late blight of potato.

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