

Varietal reaction against early blight of potato in plains of West Bengal

S. DEY AND ¹A. CHAKRABORTY

Department of Plant Pathology, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal

¹AICRP on Potato, Directorate of Research,

Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal

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Potato (*Solanum tuberosum* Linn), belonging to the family Solanaceae is an important starchy food crops in both sub-tropical and temperate regions. It occupies the largest area under any single vegetable crop and it produces more food per unit area than cereals and that too in a short period of time. The potato is widely grown on a world scale and ranks fourth in food production after rice, wheat and maize (Singh, 2008). In West Bengal it has been observed critically that the incidence of several fungal, bacterial and viral diseases affect the crop almost each and every year. Among them one of the important fungal diseases is early blight which affects leaves and stems and causes heavy losses. In India, it occurs in the Indo-Gangetic plains and the Nilgiris. In India, it is more common than late blight and may cause upto 40% loss in yield of tubers. The damage to the tuber is considerable as the peak period of attack coincides with the period of tuber formation. Average annual yield loss of potato due to this disease is approximately 75% of the total production depending upon the nature of the disease, weather conditions and type of cultivars.

The present investigation was carried out to find the reaction of different potato cultivars against early blight disease and the objective of the investigation was to sort out the varieties which are less susceptible to the disease and better adapted to West Bengal climatic condition.

The experiment was conducted at Adisaptagram Block Seed Farm, Hooghly (23.5°N latitude and 89°E longitude) at 9.75m above sea level during 2009-2010 crop season. The winter is short, mild and generally lasts for middle of November to middle of February. Here the day length is short which is suitable for growing of short duration potato varieties. The monthly maximum and minimum temperature during this winter season are nearly below 30°C and 20°C respectively. The rainfall during the winter season is very low and sporadic and daily sunshine hour is about 8 hours.

Ten varieties like Kufri Chandramukhi, Kufri Pukhraj, Kufri Jyoti, Kufri Chipsona - 1, Kufri Jawahar, Kufri Anand, Kufri Giriraj, Kufri Ashoka, Kufri Surya and Kufri Bahar were selected for this investigation. All the varieties were planted on 16th

November, 2009. The per cent disease incidence and intensity was recorded at 7 days interval starting from first appearance of the disease. The intensity percent was recorded following descriptive (0-5) grade scale (Anon., 1985).

Rating	Description
0	Free from infection
1	1 – 10% leaf area damaged
2	10.1 – 20% leaf area damaged
3	20.1 – 50% leaf area damaged
4	50.1 – 75% leaf area damaged
5	Above 75% leaf area damaged

The percent disease intensity (PDI) was calculated using the formula developed by McKinney (1923).

$$PDI = \frac{\text{Sum of all numerical ratings}}{\text{Total no. of compound leaves observed} \times \text{Maximum ratings}} \times 100$$

Field reaction of different potato varieties to early blight disease of potato was determined for screening against such disease under natural field condition. Varieties were rated as per technique followed by Gupta *et al.* (1982).

Rating	Reaction	Description
0	Resistant (R)	Plants completely free from disease infection.
1	Moderately Resistant (MR)	1 – 2% plants infected.
2	Moderately Susceptible (MS)	2 – 5% plant population infected.
3	Susceptible (S)	5 – 10% plants infected.
4	Highly Susceptible (HS)	More than 10% plants infected.

During the crop season, various meteorological data. were recorded from the Department of Physics and Agricultural Meteorology, BCKV. Later, weekly average of maximum and minimum temperature, maximum and minimum RH and sunshine hour for the entire cropping season were calculated.

Table 1: Percent incidence and intensity of early blight in different varieties of potato

Varieties	First appearance		Disease incidence after first appearance (%)			Disease intensity after first appearance (%)			
	Date	Disease incidence (%)	Disease intensity (%)	7 days	14 days	21 days	7 days	14 days	21 days
Kufri Chandramukhi	29.01.2010	1.04	0.27	4.17	5.21	6.25	1.73	2.80	4.27
Kufri Pukhraj	29.01.2010	5.21	1.60	17.71	22.92	27.08	13.20	18.40	22.27
Kufri Jyoti	05.02.2010	2.06	1.20	3.09	4.12	-	1.47	1.87	-
Kufri Chipsona - 1.	29.01.2010	3.06	0.93	11.22	12.24	15.31	5.20	5.87	7.33
Kufri Jawahar	29.01.2010	3.06	1.07	12.24	27.55	33.67	8.40	17.73	23.87
Kufri Anand	29.01.2010	5.62	1.87	19.10	34.83	40.45	11.33	18.13	25.87
Kufri Giriraj	29.01.2010	4.60	2.00	13.79	36.78	43.68	10.67	23.60	27.73
Kufri Ashoka	05.02.2010	2.25	0.53	6.74	12.36	-	1.73	3.20	-
Kufri Surya	29.01.2010	1.05	0.13	5.26	11.58	18.95	1.07	4.00	6.27
Kufri Bahar	29.01.2010	1.01	0.00	5.05	7.07	8.08	1.73	3.87	4.40

Table 2: Meteorological data throughout the disease period of early blight

Date	Weather parameters					
	Temperature (°C)		Rainfall (mm)	RH (%)		Sunshine hour
	Max.	Min.		Max.	Min.	
23.01.2010 - 29.01.2010	26.40	8.39	0.00	93.14	40.29	8.97
30.01.2010 - 05.02.2010	27.51	9.81	0.00	92.29	34.86	9.06
06.02.2010 - 12.02.2010	29.01	13.60	0.00	92.29	44.29	6.99
13.02.2010 - 19.02.2010	28.90	16.64	0.20	92.71	48.57	7.46

Table 3: Correlation of early blight of potato with weather parameters during 2009-2010 under West Bengal condition

	Disease incidence (%)						Disease intensity (%)					
	Max. Temp. (°C)	Min. Temp. (°C)	Rainfall (mm)	Max. RH (%)	Min. RH (%)	Sunshine hour	Max. Temp. (°C)	Min. Temp. (°C)	Rainfall (mm)	Max. RH (%)	Min. RH (%)	Sunshine hour
'r' value	0.97	0.98	0.70	-0.48	0.74	-0.85	0.96	0.97	0.71	-0.49	0.72	-0.83
't' value (cal)	5.64	6.96	1.39	-0.77	1.56	-2.28	4.85	5.64	1.43	-0.79	1.47	-2.10

The disease incidence and intensity percentage were recorded on ten potato varieties; by observing the visual symptoms of the diseases. The number of infected plants per plot and the percentage of infected leaf area were recorded at weekly intervals.

From the results, it is revealed that early blight was first observed on 29th January, 2010 *i.e.* about 75 days after planting in the varieties like K. Chandramukhi, K. Pukhraj, K. Chipsona - 1, K. Jawahar, K. Anand, K. Giriraj, K. Surya and K. Bahar with varying incidence and intensity per cent like 1.04% and 0.27%, 5.21% and 1.60%, 3.06% and 0.93%, 3.06% and 1.07%, 5.62% and 1.87%, 4.60% and 2.00%, 1.05% and 0.13% and 1.01% and 0%, respectively (Table 1). Thereafter, incidence and intensity percent of the disease increased gradually and maximum incidence and intensity per cent were observed 21 days after first appearance of the symptoms. Maximum incidence and intensity per cent were observed in the variety K. Giriraj (43.68% and 27.73%) followed by K. Anand (40.45% and 25.87%), K. Jawahar (33.67% and 23.87%), K. Pukhraj (27.08% and 22.27%), K. Surya (18.95% and 6.27%) and K. Chipsona - 1 (15.31% and 7.33%). This finding is also in the line with Basu and De (2003) was observed that incidence of early blight of potato varied from 19.1% to 30.5% from year to year depending upon the weather condition. Least incidence and intensity percent were observed in the varieties K. Chandramukhi (6.25% and 4.27%) and K. Bahar (8.08% and 4.40%).

In varieties Kufri Jyoti and Kufri Ashoka, early blight appeared one week later *i.e.* 5th February, 2010 with incidence and intensity percent of 2.06% and 1.20% and 2.25% and 0.53% respectively. Maximum incidence and intensity per cent were observed 4.12% and 1.87% and 12.36% and 3.20% respectively in those varieties such as Kufri Jyoti and Kufri Ashoka at 14 days after first appearance of the symptoms.

From meteorological observation (Table 2) it can be observed that seven days prior to first appearance of early blight disease of potato the average maximum and minimum temperature varied between 26.40°C to 27.51°C and 8.39°C to 9.81°C respectively; average maximum and minimum relative humidity varied between 92.29% to 93.14% and 34.86% to 40.29% respectively and average sunshine hours per day varied between 8.97 to 9.06. During the period of maximum disease intensity the average maximum and minimum temperature, the average maximum and minimum relative humidity

and the average sunshine hours per day were 28.90°C and 16.64°C, 92.71% and 48.57% and 7.46 hours.

Correlation studies of potato early blight disease incidence and intensity with weather parameters such as maximum temperature, minimum temperature, rainfall, maximum relative humidity, minimum relative humidity and sunshine hour were also made. It was found that the correlation coefficients between early blight disease (incidence and intensity) and maximum temperature, minimum temperature, rainfall, minimum relative humidity and sunshine hour were significant. Maximum temperature, minimum temperature, rainfall and minimum relative humidity have got positive impact on disease incidence while the sunshine hour has negative impact.

From the results it can be concluded that the varieties Kufri Giriraj, Kufri Anand, Kufri Jawahar, Kufri Pukhraj, Kufri Surya, Kufri Chipsona - 1 and Kufri Ashoka were highly susceptible whereas Kufri Bahar and Kufri Chandramukhi were susceptible to early blight disease. The variety Kufri Jyoti was moderately susceptible to this disease but no variety showed moderately resistant or resistant reaction against early blight of potato. The intensity of early blight coincided with warm and humid weather and with shorter day length.

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