

Early blight management and its effects on tuber yield of two potato cultivars under varied environmental condition*

H. R. PATEL, A. M. SHEKH, J. G. PATEL, A. MISHRA, G. B. VALAND,
G. C. PATEL, R. N. PANDEY and D. S. MISTRY

Gujarat Agricultural University, B. A. College of Agriculture, Anand Campus Anand

ABSTRACT

The results of three years field experiment on early blight management of two potato cultivars (Kufri Badshah and K. Lauvker) under varied environmental conditions showed fungicidal (mencozeb @ 0.2 %) treatment to be significantly effective. One spray of fungicide yielded 19% while two sprays yielded 29% higher tuber yield than no spray. Both the early blight management treatments (one and two spray) found superior over no spray. Correlation study between early blight of potato and preceding seven days mean of various weather parameters showed positive significant association with evaporation rate followed by maximum temperature, relative humidity and bright sunshine hours. Based on significant association linear regression has been developed for prediction of disease intensity ($R^2 = 0.532$). Based on the early blight initiation (first early blight lesion on potato leaf) mean disease initiation day was computed and thereby prophylactic spraying day was fixed for effective and economic control of early blight of potato under field condition.

Key words: Early blight, weather parameters, spraying

Early blight (*Alternaria solani* (E&M) Jones and Grout) of potato (*Solanum tuberosum* L.) has been recognized since its discovery causing yield losses up to 40% (Haware, 1968). The incidence of disease is mostly influenced by high moisture which is provided by heavy dews, light rain or irrigation, planting time, variety, age of the crop, inoculums, warm temperature and vigour of the plant (Easton *et al.*, 1975; Harrison *et al.*, 1965; Ohms and Fenwick, 1961). The disease is also favoured by short rotation, continuous potato

cropping and not by burning the tops (Menzer and Merrian, 1974). Tuberization stage of the crop is most critical for disease initiation. Harrison and Venette (1970) suggested protectant application of fungicide than frequent high dose chemical application.

A simple day-degree model was developed by France *et al.* (1988) to predict appearance of disease in Colorado area.

The scientific information on disease initiation, development, its spread and

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Table 1 : Tuber yield of potato and disease index as influenced by planting dates, varieties, and number of mancozeb (0.2%) sprays

Treatments	Tuber yield (t ha ⁻¹)				
	1995-96	1996-97	1998-99	Pooled	Disease index
Planting dates(D)					
3 rd week of Nov.(D ₁)	18.19	37.57	32.83	29.63	2.745
1 st week of Dec.(D ₂)	15.59	35.02	28.46	26.32	2.868
3 rd week of Dec.(D ₃)	7.92	26.98	20.88	18.59	2.723
S. Em.	0.78	1.29	1.08	0.60	0.0371
CD at 5%	2.70	4.47	3.75	1.79	NS
CV%	27.59	19.05	19.40	20.58	6.93
Varieties (V)					
K. Badshah(V ₁)	15.06	34.39	28.64	26.09	2.466
K. Lauvker(V ₂)	12.67	31.99	26.14	23.60	3.092
S. Em.	0.38	0.46	0.43	0.24	0.0276
CD at 5%	1.09	1.32	1.20	0.69	0.498
Spraying(S)					
No spray(S ₀)	12.51	25.50	22.86	20.38	3.652
One spray(S ₁)	13.81	35.57	26.51	25.39	2.559
Two spray(S ₂)	15.28	38.51	32.80	28.87	2.125
S. Em.	0.47	0.57	0.52	3.17	0.0338
CD at 5%	1.33	1.61	1.48	NS	0.205
CV%	16.52	8.35	9.38	10.25	5.97
Significant interaction	DxV	DxV,DxS	DxS	YxDxV,Yx DxS, YxS, DxS	YxDxVxSxP

effective and economic spraying schedule under different environmental condition is meager and hence field trial was conducted with three date of planting with two potato cultivars and three early blight management treatments.

MATERIALS AND METHODS

The investigation was carried out in split plot design with four replications during

1995-96, 1996-97 and 1998-99. Main plot comprised of three dates of planting (D₁: 3rd week of Nov., D₂: 1st week of Dec. and D₃: 3rd week of Dec.). In sub plot treatment two local grown cultivars (V₁: Kufri Badshah and V₂: K. Lauvker) with three treatments of early blight management (S₀: No spray, S₁: One spray of recommended fungicide (mencozeb @ 0.2%) at the time of appearance of disease symptoms and S₂:

Table 2 : Correlation coefficient between early blight of potato and preceding seven days mean of various weather variables

Sr. No.	Weather variables	Year			
		1995-96	1996-97	1998-99	Pooled
1.	Evaporation	0.56 **	0.87 **	0.79 **	0.73 **
2.	Bright Sunshine hours	0.28	0.48 **	0.31	0.35 **
3.	Wind speed	-0.37	-0.35	0.43 **	-0.05
4.	Max. temp.	0.56 **	0.82 **	0.70 **	0.67 **
5.	Min. temp.	0.20	0.59 **	0.68 **	0.46 **
6.	Mean temp.	0.07	0.77 **	0.70 **	.046 **
7.	RH (0738)	-0.47 **	-0.40	-0.47 **	-0.47 **
8.	RH (1438)	-0.52 **	-0.68 **	-0.37	-0.52 **
9.	Mean RH	-0.56 **	-0.72 **	-0.45 *	-0.57 **
		N=18	N=18	N=18	N=54

* : Significant at 5% level ** : Significant at 1% level

Table 3: Disease initiation period from date of planting

Year	Days from date of planting		
	D ₁	D ₂	D ₃
1995-96	35	29	36
1996-97	34	30	27
1998-99	30	29	28

Mean disease initiation date: 31

first spray same as S₁ and second spray 15 days later in a plot size of 4.00 x 2.25m. Planting distance was kept 45x20 cm. Crop was fertilized with 220 + 110 + 220 NPK kg ha⁻¹ uniformly. Transplanting was carried out by wet method. Weekly weather data from the Agro - Met observatory adjacent to the experimental site have been used. The periodic disease index (0 to 9 scale) was recorded at 10 days interval starting from

36 DAP (days after planting) to 86 DAP during tuber formation stage of the crop. First disease initiation date in all the plantings was also recorded.

RESULTS AND DISCUSSION

Treatment effect on tuber yield

Individual as well as pooled analysis (Table 1) shows that significantly highest tuber yield in D₁ followed by D₂ and D₃. In case of varieties, K. Badshah (V₁) gave significantly higher tuber yield as compared to K. Louvker (V₂).

Fungicidal spraying schedule was found significant in individual and in pooled analysis under YxDxS interaction. One spray of fungicide (S₁) yielded 19 % and two sprays (S₂) yielded 29 % higher tuber yield than no spray (S₀) treatment. On an average S₂ yielded 12 % higher tuber than

S_1 fungicidal spraying treatment. This shows that early blight management treatment (S_1 and S_2) superior in getting higher tuber yield than no spray (S_0).

Treatment effects on disease index (0 to 9 scale)

The results of three years pooled data on periodic disease index (36,46,56,66,76 and 86 DAP) showed (Table 1) non-significant difference amongst different dates of planting, while it differed significantly due to varieties and spraying schedule. Nearly 20 % higher disease index was recorded in K. Lauvker than K. Badshah which seems to be comparatively more tolerant to early blight disease than K. Lauvker. Significant differences were also observed in number of spraying treatments. About 29 and 42 % less disease index was recorded in S_1 and S_2 treatments as compared to S_0 respectively. This suggests the superiority of fungicidal spray for early blight management over no spray.

Early blight-weather relationship

The periodic disease index during yield formation stage of the crop and preceding seven days mean of effective weather variables have been correlated to ascertain the effective weather parameter responsible for disease development (Table 2). Based upon significance of weather parameters in individual as well as combined analysis, the stepwise regression study has been performed for development of prediction model.

$$DI = -1.2383 + 1.1540**EP \dots (R^2=0.532)$$

where,

DI: disease index and

EP: weekly evaporation rate

Thus, the inoculum load of pathogen could be predicted by knowing disease intensity, which helps the growers for early warning for fungicidal spray.

Early blight spray management

The disease initiation (first early blight lesion on leaf) time was recorded in all the plantings and years (Table 3). Based upon first initiation average disease initiation date was computed to be 30th DAP. This simple information suggests that prophylactic spraying should be carried out earlier to this period. Keeping close watch from the 25th day such prophylactic management based on actual field experiments might prove very useful in management of early blight of potato by reducing number of sprays due to effective control of pathogen and thus minimize the input costs to great extent.

CONCLUSIONS

It is concluded from foregoing results that considering the effectiveness in controlling the infection and yield obtained by fungicidal spraying treatment it is advised to plant potato cv. K. Badshah in third week of November in the study region and to go for prophylactic spray of mancozeb @0.2 % at 25 DAP followed by second spray after 15 days for higher tuber yield through effective and economical control of early blight of potato compared to potato cv. K.

Lauvker.

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