

## Assessment of yield losses due to mild mosaic (PVX), severe mosaic (PVY) and leaf roll (PLRV) diseases on potato in the plains of West Bengal

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Studies were conducted for two successive *rabi* seasons (1993-94 and 1994-95) at the University Farm, Kalyani, West Bengal to know the extent of yield losses due to mild mosaic (PVX), severe mosaic (PVY) and leafroll (PLRV) diseases of potato (cv. Kufri Chandramukhi) under natural field condition. The results revealed that infection caused reduction in number, weight of tubers per hill and weight of individual tubers. Reduction in yield due to mild mosaic, severe mosaic and leafroll was found to be 25.9 - 48.6%, 59.6 - 77.9% and 50.2 - 68.7% respectively. Simultaneously number of tubers per hill and weight of individual tubers were greatly reduced due to infection of these viruses.

**Key words :** Potato yield loss, mild mosaic, severe mosaic, leafroll

### INTRODUCTION

The potato crop in the plains of West Bengal is affected by large number of virus diseases viz. PVX, PVY, PLRV, PVA, PVS, PVM, acuba mosaic, rugose mosaic and crinkle of potato and which are very often observed in the fields of West Bengal. Among these PVX, PVY and PLRV are more wide spread and take heavy toll in yield by infecting the crop at any stage of growth of the plant.

Yield reduction of potato due to mild mosaic, severe mosaic and leafroll were observed to be 41.3%, 20-76% and 73.3% respectively (Chattopadhyay and Das, 1959). PLRV and PVY caused the highest yield reduction from 72-92% followed by potato mild mosaic 52% (Vasudeva and Azad, 1952). Severe strain of PVY alone could reduce yield up to 60-70% while mild mosaic (PVX) could reduce yield up to 10-30% (Khurana and Singh, 1988; Nagaich *et al.*, 1974). The present study was undertaken with an objective to know the extent of yield losses due to mild mosaic, severe mosaic and leafroll diseases of potato under natural field conditions in the plains of West Bengal.

### MATERIALS AND METHODS

Virus free breeder seed potato of cv. Kufri

Chandramukhi were planted at the University Farm located at Kalyani (West Bengal) in about one acre area at the end of November following recommended agronomic practices of the region for two successive *rabi* seasons (1993-94 and 1994-95). The crop plant (45 to 60 days old) showing mild mosaic (PVX), severe mosaic (PVY) and leafroll (PLRV) symptoms were selected and tagged. For each disease 100 plants were tagged. Selection of mild mosaic infected plants were done symptomatologically and serologically where as severe mosaic and leafroll infected plants were selected symptomatologically and in a few cases histochemical testing were done for leafroll infected plants. For comparison, 100 healthy plants were selected and tested serologically for the PVX and tagged. All the tagged plants were harvested individually at the full maturity of the crop (90 days). The data were recorded on the following aspects like yield of individual plants, number of tubers per plant and weight of individual tubers. The 100 individual plants are divided into 10 lots and every lot containing 10 plants. Yield loss assessment of potato in field, due to mild mosaic, severe mosaic and leafroll infection were done following the method described by Chester (1955). The per cent loss in yield was calculated by the following formula.



**Table 1 :** Percentage of reduction in yield by different diseases-mild mosaic (PVX), severe mosaic (PVY) and leafroll (PLRV) after full maturity of the crop (1993-94).

Lot No.	Healthy plants			Mild Mosaic (PVX) infected plants				Severe mosaic (PVY) infected plants				Leaf roll (PLRV) infected plants			
	Av. Yield gm./plant	Av. no. of tubers	Av. wt. /tuber gm.	Av. yield gm.	Av. no. of tubers/plant	Av. wt. /tuber gm.	%of yield reduction	Av. yield tubers/gm.	Av. no. of tuber plant	Av. wt. /tuber gm.	% of yield reduction	Av. yield gm.	Av. no. of tubers/plant	Av.wt. /tuber gm.	% of yield reduction
I	614.00	12.20	50.32	315.20	9.80	32.16	48.66	152.00	9.20	16.58	75.14	192.00	6.00	32.00	68.72
II	437.00	10.20	42.84	278.80	8.60	32.40	36.20	160.00	9.00	17.77	63.30	171.40	6.30	25.96	60.77
III	435.40	8.40	51.83	305.20	7.20	42.38	29.90	152.80	8.00	19.10	64.90	205.40	7.60	27.02	52.82
IV	479.40	10.60	45.22	291.60	13.00	20.12	42.92	105.80	7.60	13.92	77.90	185.70	7.80	23.80	61.26
V	439.00	10.40	42.21	279.00	10.00	27.90	36.40	149.40	7.40	20.18	65.96	211.70	8.20	25.81	51.77
VI	437.00	11.20	39.01	289.00	9.40	30.74	33.80	144.00	7.80	18.46	67.04	176.00	7.00	25.14	59.72
VII	418.80	10.60	39.50	291.50	8.40	37.70	30.39	132.00	6.20	21.29	68.48	165.50	5.40	30.64	60.48
VIII	500.00	9.20	54.34	326.80	12.60	30.39	25.93	176.00	8.60	20.46	64.80	245.00	8.80	27.48	51.00
IX	470.00	9.00	52.22	326.00	9.40	34.68	34.64	134.00	9.60	13.95	71.40	221.20	8.40	26.33	52.91
X	441.00	10.20	43.23	285.00	8.60	33.13	35.37	150.40	7.20	20.88	65.80	197.80	6.40	30.90	55.14
Mean	467.16	10.20	46.07	298.80	9.70	32.16	35.42	145.7	8.00	18.25	68.47	197.17	7.19	27.50	57.45

**Table 2 :** Percentage of reduction in yield by different diseases-mild mosaic (PVX), severe mosaic (PVY) and leafroll (PLRV) after full maturity of the crop (1994-95).

Lot No.	Healthy plants			Mild Mosaic (PVX) infected plants				Severe mosaic (PVY) infected plants				Leaf roll (PLRV) infected plants			
	Av. Yield gm./plant	Av. no. of tubers	Av. wt. /tuber gm.	Av. yield gm.	Av. no. of tubers/plant	Av. wt. /tuber gm.	%of yield reduction	Av. yield tubers/gm.	Av. no. of tuber plant	Av. wt. /tuber gm.	% of yield reduction	Av. yield gm.	Av. no. of tubers/plant	Av.wt. /tuber gm.	% of yield reduction
I	525.40	11.60	45.29	370.20	9.50	38.96	29.53	165.10	9.30	17.75	68.57	186.30	7.20	25.83	64.54
II	427.00	13.40	31.86	296.00	8.30	35.66	30.67	154.20	8.70	17.72	63.88	205.00	8.90	23.03	51.99
III	397.10	9.60	41.36	265.20	7.80	34.00	33.21	149.00	11.770	12.73	62.44	191.30	9.10	21.02	51.82
IV	587.00	12.70	46.22	310.80	12.50	24.86	47.05	202.30	12.40	16.58	65.53	218.60	7.80	28.02	62.75
V	421.20	10.30	40.89	285.20	11.30	25.23	32.28	121.50	9.50	12.78	71.15	177.20	7.60	23.31	57.92
VI	535.40	11.80	45.37	349.20	10.60	32.94	34.77	142.80	7.20	19.83	73.32	235.00	8.40	27.97	56.10
VII	468.80	9.70	50.18	319.50	14.10	22.65	31.80	105.00	6.90	15.21	77.60	202.80	9.60	21.25	56.74
VIII	478.60	13.90	34.43	289.30	9.60	30.13	39.55	186.00	8.90	20.89	61.13	172.00	10.10	17.02	64.06
IX	405.00	13.20	30.68	297.00	8.50	34.94	26.66	163.3.	10.50	15.55	59.67	196.40	6.80	28.88	51.50
X	424.20	9.80	43.28	316.20	10.0	31.62	25.45	148.20	11.00	13.47	65.06	2110.	6.50	32.46	50.25
Mean	466.9	11.60	40.90	309.86	10.22	31.09	33.03	153.70	9.61	16.25	66.83	199.5	8.20	24.87	56.76

$$Q = \frac{a - b}{a} \times 100$$

where Q = per cent yield loss

a = average yield from a healthy plant.

b = average yield from a diseased plant.

Tests of significance ('t' value) were determined between healthy and infected mild mosaic, severe mosaic and leafroll plants on different parameters i.e. average yield of individual plant, number of tubers per plant and average weight of individual tuber.

## RESULTS AND DISCUSSION

From the data presented in Tables 1 and 2 indicated that average tuber yield from each healthy plant varied from 437 to 614g, average number of tuber per plant varied from 8.4 to 12.2 and average weight of individual tuber varied from 39.01 to 54.3 g during the first year. Similarly during the second year average tuber yield from individual plant varied from 397.1 to 587.0 g, average number of tubers per plant varied from 9.6 to 13.9 average weight of individual tuber varied from 30.68 to 50.18 g. Average tuber yield from individual mild

Table 3 : Calculated "t" values of different parameters (1993-94).

	Healthy plants			Mild Mosaic (PVX) infected plants				Severe mosaic (PVY) infected plants				Leaf roll (PLRV) infected plants			
	Av. Yield gm./plant	Av. no. of tubers	Av. wt. /tuber gm.	Av. yield gm.	Av. no. of tubers/plant	Av. wt. /tuber gm.	%of yield reduction	Av. yield tubers/gm.	Av. no. of tu-plant	Av. wt. /tuber gm.	% of yield reduction	Av. yield gm.	Av. no. of tubers/plant	Av.wt. /tuber gm.	% of yield reduction
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	X <sub>7</sub>	X <sub>8</sub>	X <sub>9</sub>	X <sub>10</sub>	X <sub>11</sub>	X <sub>12</sub>	X <sub>13</sub>	X <sub>14</sub>	X <sub>15</sub>
X <sub>1</sub>	-	-	-	9.970**	-	-	-	18.950**	-	-	-	14.80**	-	-	-
X <sub>2</sub>	-	-	-	-	0.765	-	-	-	4.463**	-	-	-	6.000**	-	-
X <sub>3</sub>	-	-	-	-	-	5.42**	-	-	-	14.965**	-	-	-	9.941**	-
X <sub>4</sub>	-	-	-	-	-	-	-	18.490**	-	-	-	10.629	-	-	-
X <sub>5</sub>	-	-	-	-	-	-	-	-	2.56*	-	-	-	3.796**	-	-
X <sub>6</sub>	-	-	-	-	-	-	-	-	-	7.248**	-	-	-	2.149*	-
X <sub>7</sub>	-	-	-	-	-	-	-	-	-	-	13.045**	-	-	-	8.109*
X <sub>8</sub>	-	-	-	-	-	-	-	-	-	-	-	5.323**	-	-	-
X <sub>9</sub>	-	-	-	-	-	-	-	-	-	-	-	-	1.788	-	-
X <sub>10</sub>	-	-	-	-	-	-	-	-	-	-	-	-	-	7.608**	-
X <sub>11</sub>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.702**
X <sub>12</sub>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X <sub>13</sub>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X <sub>14</sub>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X <sub>15</sub>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

\* = Significant at P = (0.05)

\*\* = Significant at P = (0.01)

Table 4 : Calculated "t" values of different parameters (1994-95).

	Healthy plants			Mild Mosaic (PVX) infected plants				Severe mosaic (PVY) infected plants				Leaf roll (PLRV) infected plants			
	Av. Yield gm./plant	Av. no. of tubers	Av. wt. /tuber gm.	Av. yield gm.	Av. no. of tubers/plant	Av. wt. /tuber gm.	%of yield reduction	Av. yield tubers/gm.	Av. no. of tu-plant	Av. wt. /tuber gm.	% of yield reduction	Av. yield gm.	Av. no. of tubers/plant	Av.wt. /tuber gm.	% of yield reduction
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	X <sub>7</sub>	X <sub>8</sub>	X <sub>9</sub>	X <sub>10</sub>	X <sub>11</sub>	X <sub>12</sub>	X <sub>13</sub>	X <sub>14</sub>	X <sub>15</sub>
X <sub>1</sub>	-	-	-	7.399**	-	-	-	15.20**	-	-	-	14.403**	-	-	-
X <sub>2</sub>	-	-	-	-	1.70	-	-	-	2.569*	-	-	-	5.296**	-	-
X <sub>3</sub>	-	-	-	-	-	3.715**	-	-	-	11.77**	-	-	-	6.459**	-
X <sub>4</sub>	-	-	-	-	-	-	-	11.775**	-	-	-	9.832**	-	-	-
X <sub>5</sub>	-	-	-	-	-	-	-	-	0.722	-	-	-	2.298*	-	-
X <sub>6</sub>	-	-	-	-	-	-	-	-	-	8.147**	-	-	-	2.810*	-
X <sub>7</sub>	-	-	-	-	-	-	-	-	-	-	12.530**	-	-	-	9.020**
X <sub>8</sub>	-	-	-	-	-	-	-	-	-	-	-	4.325**	-	-	-
X <sub>9</sub>	-	-	-	-	-	-	-	-	-	-	-	-	2.08	-	-
X <sub>10</sub>	-	-	-	-	-	-	-	-	-	-	-	-	-	5.203	-
X <sub>11</sub>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.027**
X <sub>12</sub>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X <sub>13</sub>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X <sub>14</sub>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X <sub>15</sub>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

\* = Significant at P = (0.05)

\*\* = Significant at P = (0.01)



mosaic diseased plants varied from 278.8 to 326.0 g, average number of tuber per plant varied from 7.2 to 13.0 and average weight of individual tubers varied from 20.12 to 42.38 g during the first year. Similarly in the second year of study, the average tuber yield varied from 296.0 to 370.2 g average number of tuber per plant varied from 22.65 to 38.96 g. Overall yield reduction due to mild mosaic varied from 25.93 to 48.66%.

Tuber yield from individual severe mosaic diseased plant (PVY) varied from 105.8 to 176.0 g, average number of tubers per plant varied from 6.2 to 9.6 and average weight of individual tuber varied from 13.92 to 21.29 g during the frist year. During the second year of study, average tuber yield varied from 105 to 186 g, average number of tubers per plant varied from 6.9 to 12.4 abd average weight of tubers varied from 13.47 to 20.89g. The per cent of yield reduction varied from 59.67 to 77.90%. In the first year study the average tuber yield from individual leafroll diseased (PLRV) plant varied from 165.5 to 245.0 g, average number of plants varied from 5.4 to 8.8 and average weight of tuber varied from 25.14 to 32.0 g. During the second year average tuber yield from individual leaf roll diseased plant varied from 6.5 to 10.0 and average weight of individual tuber varied 17.02 to 32.46 g. The per cent of yield reduction varied from 50.25 to 77.60%. Above findings are in line with those of Vasudeva and Azad (1952), Nagaich *et al.* (1974) and Khurana and Singh (1988). From the data presented in the Tables 3 and 4 indicated that the average yield of individual plant and average weight of individual tuber of infected plants (mild mosaic,

severe mosaic and leafroll) differ significantly with the healthy plants in both the years at 5% and 1% level.

The difference between average numbers of tubers obtained from the healthy plants and mildmosaic (PVX) infected plants were found to be insignificant in both the years, whereas, it was found significant differences were also observed among the mild mosaic, severe mosaic and leafroll diseases in respect of average yield of individual plant and average weight of individual tuber in both the seasons, while it was insignificant for average number of tuber per plant in most of the cases.

The percentage of yield reduction due to mild mosaic, severe mosaic and leafroll diseases were found to be highly significant in both the seasons.

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