Environment & Ecology 35 (4C) : 3277—3282, October—December 2017
Website: environmentandecology.com ISSN 0970-0420

Survey of Viral Diseases of Potato in Begusarai and Samastipur Districts of North Bihar

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Received 25 February 2017; Accepted 28 March 2017; Published online 17 April 2017

Abstract The survey was conducted during 2013-14 and 2014-15 to assess the incidence of viral diseases on cv Kufri Pokheraj and cv Kufri Jyoti in Begusarai and Samastipur districts. In Begusarai district, the mosaic incidence ranged from 7.45 to 11.90%, leaf roll incidence ranged from 6.78 to 10.35% and that of total viral disease incidence ranged from 14.23 to 22.25% were recorded on Kufri Pokharaj where as mosaic incidence ranged from 5.35 to 7.10%, leaf roll incidence ranged from 4.85 to 6.80% and total viral desease incidence ranged from 10.35 to 13.90% were recorded on Kufri Jyoti. In Samastipur district the mosaic incidence ranged from 15.30 to 23.20%, leafroll incidence ranged from 12.80 to 19.25% and total viral disease incidence ranged from 28.10 to 41.85% were recorded on Kufri Pokheraj where as mosaic disease incidence ranged from 6.98 to 11.15%, leaf roll incidence ranged from 6.24 to 10.65% and total viral disease incidence ranged from 12.22 to 21.57% were recorded on Kufri Jyoti. The mean of average of mosaic incidence (9.29%), mean of average of leaf roll incidence (8.27%) and mean of average of total viral disease incidence (17.56%) on Kufri Pokheraj and mean of average of mosaic incidence (5.89%), mean of average of leaf roll incidence (5.44%) and mean of average of total viral disease incidence (11.33%) on Kufri Jyoti were recorded from Begusarai district.The mean of average of mosaic incidence (19.65%), mean of average of leaf roll incidence (16.45%) and mean of average of total viral disease incidence (36.10%) on Kufri Pokheraj though mean of average of mosaic incidence (8.59%), mean of average of leaf roll incidence (8.18%) and mean of average of total viral disease incidence (16.77%) in Kufri Jyoti were recorded from Samastipur district.

Keywords Potato, Disease incidence, Mosaic, Leaf roll, Viral disease.

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Introduction

Potato (*Solanum tuberosum* L.) is one of the important and widely cultivated vegetable crop of India. India's total production of potato ranks fourth in the world although in cultivated area it ranks third [1]. In India potato is cultivated in 20.32 Lakh hectares producing 46.61 million metric tonnes of tubers with productivity of 22.9 tonnes per hectares. Bihar ranks third after Uttar Pradesh and West Bengal in terms of area, production and productivity. In Bihar potato is cultivated in 3.18 lakh hectares producing 6.53 million metric

tonnes of tuber with productivity of 19.7 tonnes per hectare [2]. Low productivity of potato in Bihar is mainly due to non-availability of healthy seed material and there is requirement of a very large quantity of healthy potato seed for its successful cultivation without losing productivity. Potato production is not an easy task as potatoes are affected by multiple key pests including several viruses which contribute to running out or degeneration of seed stocks. Worldwide potato crop in infected by more than 36 viruses and viroid [3, 4]. Studies on the cause of degeneration of potato seed in the country showed that the aphid, particularly *Myzus percae* (sulzer) is responsible for the spread of virus disease in the fields. Viral diseases are prevalent throughout the country but are severe in North Bihar where population of aphid vector is high throughout the crop season. Vegetative propagation of same stocks used year after year results in cumulative infiltration of pathogens, particiularly the prevalent viruses which spread both through contact and aphid /vectors [5]. Further infection of viruses has strong debilitating effect bringing down the yield potential of the infected plants/ crop. Therefore, the effects have been made to assess the incidence of viral diseases of potato spread in five blocks of Begusarai and five blocks of Samastipur districts of North Bihar. The present study was also undertaken to identify the locations with low aphid pressure and suitable varieties for minimum degeneration of seed stocks for multiplying healthy seed. The good quality of healthy seed stocks will be made available at farmers door steps so that potato crop productivity will be increased.

Materials and Methods

A systematic survey was conducted in major potato growing areas of North Bihar viz. Begusarai and Samastipur districts respectively to know the status of mosaic and leaf roll incidence on potato in farmers fields during 2013-15. The natural incidence of viral disease was recorded at 15 days before dehaulming during the *rabi* cropping season of both the years 2013-14 and 2014-15. The survey was conducted in 180 fields spread over five blocks viz. Khodawandpur, Cheriabariarpur, Naokothi, Bakhari and Begusarai of Begusarai districts where as in Samastipur district survey was also conducted in 180 fields spread over five blocks viz. Bivutipur, Hasanpur, Dalsinghsarai, Rosera and Vidyapatinagar, each block of both the districts six villages, in each village six fields and each field six lines were randomly selected. The potato fields selected for studies were managed and maintained with inputs and culture practices by the farmers themselves at all the locations. The total number of plants and number of plants showing mosaic and leaf roll symptoms were recorded in each row. The percent disease incidence was calculated by using the formula.

$$\text{Percent disease incidence (PD1)} : = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

Results and Discussion

In Begusarai district (Table 1) the highest mosaic incidence of 11.90% in Kufri Pokheraj and 7.10% in Kufri Jyoti were respectively recorded from the fields of Chakmuzaffar village under Naokothi block and Bashi village under Cheriabariyarpur block, whereas the lowest mosaic incidence of 7.45% in Kufri Pokheraj and 5.35% in Kufri Jyoti were respectively recorded from Simri village under Bakhri block and Fafaut village under Khodawandpur block. Similarly the maximum leaf roll incidence of 10.35% is Kufri Pokheraj and 6.80% in Kufri Jyoti were respectively recorded from the fields of Chakmuzaffar village of Naokothi block and Bashi village of Cheriabariyarpur block though the minimum leaf roll incidence of 6.78 in Kufri Pokheraj and 4.85% in Kufri Jyoti were respectively recorded from the fields of Simri village of Bakhri block and Ulao village of Begusarai block. The total viral disease incidence ranged from 14.23 to 22.25% in Kufri Pokheraj and from 10.35 to 13.90% in Kufri Jyoti were recorded from the fields of Begusarai district during the course of survey in two *rabi* seasons of 2013-15. In Samastipur district (Table 2) the maximum mosaic incidence of 23.20% and maximum leaf roll incidence of 19.25% in Kufri Pokheraj were respectively recorded from the fields of Shashan village of Hashanpur block and Bachhgama village of Rosera block where as minimum mosaic incidence of 15.30% and minimum leaf roll incidence of 12.80% in Kufri Pokheraj were recorded from Patelia village of Bibhutipur block.

Table 1. Incidence of potato viral diseases at various locations of Begusarai district during 2013-2015 *rabi* cropping season.

Sl. No.	Places	Varieties	Precent disease incidence		Total disease incidence (%)
			Mosaic	Leaf roll	
A : Cheria Bariyarpur block					
1.	Korjana	Kufri Pokheraj	8.18	7.90	16.08
2.	Arjun Tol	Kufri Jyoti	6.15	5.75	11.90
3.	Makaspur	Kufri Pokheraj	9.24	8.25	17.49
4.	Vikrampur	Kufri Jyoti	5.40	5.25	10.65
5.	Manjhaul	Kufri Pokheraj	10.10	8.64	18.74
6.	Bashi	Kufri Jyoti	7.10	6.80	13.90
B : Khodawnadpur block					
7	Mushahari	Kufri Pokheraj	9.80	7.34	17.14
8.	Khodawandpur	Kufri Pokheraj	10.15	8.28	18.43
9.	Matihani	Kufri Pokheraj	7.90	7.75	15.65
10.	Malmalla	Kufri Jyoti	5.45	4.90	10.35
11.	Meghaul	Kufri Jyoti	5.85	5.20	11.05
12.	Fafaut	Kufri Jyoti	5.35	5.14	10.49
C : Bakhari block					
13.	Sakarpura	Kufri Pokheraj	8.30	6.95	15.25
14.	Gangrahauo	Kufri Jyoti	5.75	5.45	11.20
15.	Simri	Kufri Pokheraj	7.45	6.78	14.23
16.	Koelamohan	Kufri Jyoti	5.72	5.55	11.27
17.	Ghaghera	Kufri Pokheraj	8.90	8.14	17.04
18.	Shivnagar	Kufri Jyoti	6.95	5.80	12.75
D : Naokothi block					
19.	Nowkothi	Kufri Jyoti	5.38	5.15	10.53
20.	Pahshara	Kufri Pokheraj	8.80	8.24	17.04
21.	Mahishwara	Kufri Jyoti	5.56	5.14	10.70
22.	Bagar	Kufri Pokheraj	8.28	7.95	15.23
23.	Babhangama	Kufri Jyoti	5.75	5.44	11.19
24.	Chakmuzaffar	Kufri Pokheraj	11.90	10.35	22.25
E : Begusarai block					
25.	Khamhar	Kufri Pokheraj	9.20	8.75	17.95
26.	Mohanpur	Kufri Jyoti	6.65	5.88	12.53
27.	Rajaura	Kufri Pokheraj	11.50	10.28	21.78
28.	Ulao	Kufri Jyoti	5.90	4.85	10.75
29.	Bandwar	Kufri Pokheraj	9.70	8.74	18.44
30.	Paharpur	Kufri Jyoti	5.48	5.30	10.78

The highest mosaic incidence of 11.15% and highest leaf roll incidence of 10.65% in Kufri Jyoti were respectively recorded from Patsa village of Hashanpur block and Bhirha village under Rosera block though minimum mosaic incidence of 6.98% and minimum leaf roll incidence of 6.24% in Kufri Jyoti were recorded from Garsisai village of Vidyapatinar block. The total viral disease incidence ranged from 28.10 to 41.85% in Kufri Pokheraj and from 12.22 to 21.57% in Kufri Jyoti were recorded from the field of Samastipur district during the course of survey in two *rabi* seasons of 2013-15.

Table 2. Incidence of potato viral diseases at various locations of Samastipur district during 2013-15 *rabi* cropping season.

Sl. No.	Places	Varieties	Present disease incidence		Total disease incidence (%)
			Mosaic	Leaf roll	
A : Bibhutipur block					
1.	Bibhutipur	Kufri Jyoti	7.20	6.95	14.15
2.	Narhan	Kufri Pokheraj	19.25	14.30	33.65
3	Patelia	Kufri Pokheraj	15.30	12.80	28.10
4.	Sankh Mohan	Kufri Jyoti	8.70	8.10	16.80
5.	Karak	Kufri Jyoti	8.35	7.95	16.30
6.	Khokhsaha	Kufri Pokheraj	18.45	15.10	33.55
B : Dalsinghsarai block					
7.	Rampur	Kufri Pokheraj	19.85	14.42	34.27
8.	Pagra	Kufri Pokheraj	19.80	16.00	35.80
9.	Konaila	Kufri Jyoti	7.70	7.20	14.90
10.	Kyota	Kufri Pokheraj	17.90	17.42	35.32
11.	Nagargama	Kufri Jyoti	8.85	8.72	17.57
12.	Harishankarpur	Kufri Jyoti	8.24	7.98	16.22
C : Vidyapatinagar block					
13.	Basti	Kufri Pokheraj	17.10	15.42	32.52
14.	Badhauna	Kufri Jyoti	8.26	8.18	16.44
15.	Mau	Kufri Pokheraj	18.84	18.20	37.04
16.	Bajitpur	Kufri Jyoti	8.00	7.35	15.35
17.	Sherpur	Kufri Pokheraj	19.45	15.68	35.13
18.	Garh Sisai	Kufri Jyoti	6.98	6.24	12.22
D : Rosera block					
19.	Bhirha	Kufri Jyoti	10.92	10.65	21.57
20.	Dharhi	Kufri Pokheraj	23.14	15.95	39.09
21	Kapan	Kufri Jyoti	8.70	8.40	17.10
22	Bachhgama	Kufri Pokheraj	21.20	19.25	40.45
23.	Kolhua	Kufri Jyoti	7.58	7.32	14.90
24.	Dyodha	Kufri Pokheraj	19.74	17.20	36.94
E : Hasanpur					
25.	Hasanpur	Kufri Pokheraj	21.25	19.15	40.40
26.	Sakarpura	Kufri Jyoti	9.80	9.10	18.90
27.	Rampur	Kufri Pokheraj	20.55	17.30	37.85
28.	Nayanagar	Kufri Jyoti	8.60	8.40	17.00
29.	Shashan	Kufri Pokheraj	23.20	18.65	41.85
30.	Patsa	Kufri Jyoti	11.15	10.25	21.40

The data (Table 3) indicate that among five blocks of Begusarai district, Begusarai block, recorded highest average of mosaic incidence (10.13%), highest average of leaf roll incidence (9.24%) and highest average of total viral disease incidence (19.37%) in Kufri Pokheraj whereas the highest average of mosaic incidence (6.21%), highest average of leaf roll incidence (5.93%) and highest average of total viral disease incidence(12.14%) in Kufri Jyoti were recorded from Cheriabariarpur block. Among the five blocks of Samastipur distict, Hasanpur block recorded maximum average of mosaic incidence (21.63%), maximum average of leaf roll incidence (18.36%) and maximum average of total viral disease incidence (39.99%) in Kufri

Table 3. Average incidence of potato viral diseases in Begusarai and Samastipur districts at block level during 2013-15 *rabi* cropping season.

Place	Kufri Pokheraj			Kufri Jyoti		
	Mosaic percent	Leaf roll percent	Total disease percent	Mosaic percent	Leaf roll percent	Total disease percent
Begusarai district block						
A. Cheria Bariarpur	9.17	8.26	17.43	6.21	5.93	12.14
B : Khodawandpur	9.28	7.79	17.07	5.55	5.08	10.63
C : Bakhari	8.21	7.29	15.50	8.14	5.60	11.74
D : Naokothi	9.66	8.84	18.50	5.56	5.24	10.80
E : Begusarai	10.13	9.24	19.37	6.01	5.34	11.35
Mean	9.29	8.27	17.56	5.89	5.44	11.33
Samastipur district block						
F : Bibhutipur	17.66	14.06	31.72	8.08	7.66	15.74
G : Dalsinghsarai	19.18	15.94	35.12	8.26	7.96	16.22
H : Vidyapatinagar	18.46	16.43	34.89	7.74	7.25	14.99
I : Rosera	21.36	17.46	38.82	9.06	8.79	17.85
J : Hasanpur	21.63	18.36	39.99	9.85	9.25	19.10
Mean	19.65	16.45	36.10	8.59	8.18	16.77

Pokheraj and maximum average of mosaic incidence (9.85%), maximum average of leaf roll incidence (9.25%) and maximum average of total viral disease incidence (19.10%) in Kufri Jyoti. In Begusarai district the lowest average of mosaic incidence (8.21%) lowest average of leaf roll incidence (7.29%) and lowest average of total viral disease incidence (15.50%) in Kufri Pokheraj were recorded from Bakhri block whereas lowest average mosaic incidence (5.55%) lowest average of leaf roll (5.08%) and lowest average of total viral disease incidence (10.63%) in Kufri Jyoti were recorded from Khodawandpur block. In Samastipur district, the lowest average of mosaic incidence (17.66%) lowest average of leaf roll incidence (14.06%) and lowest average of total viral disease incidence (31.72%) in Kufri Pokheraj were recorded from Bibhutipur block where as lowest average of mosaic incidence (8.08%) in Kufri Jyoti was recorded from Bibhutipur block though the lowest average of leaf roll incidence (7.25%) and lowest average of total viral disease incidence (14.99%) in Kufri Jyoti were recorded from Vidyapatinagar block. The data (Table 3) also indicate that the mean of average of mosaic incidence (19.65%), mean of average of leaf roll incidence (16.45%) and mean of average of total viral disease incidence (36.10%) on Kufri Pokheraj in Samastipur district were more compared to mean average of mosaic incidence (9.29%) mean of average of leaf roll incidence (8.27%) and mean of average of total viral disease incidence (17.56%) in Kufri Pokheraj in Begusarai district. The mean of average of mosaic incidence (8.59%), mean of average of leaf roll incidence (8.18%) and mean of average of total viral disease incidence (16.77%) on Kufri Jyoti were also recorded more in Samastipur district compared to mean of average of mosaic incidence (5.89%), mean of average of leaf roll incidence (5.44%) and mean of average of total viral disease incidence (11.33%) on Kufri Jyoti in Begusarai district. The mean of average of mosaic incidence (19.65%), mean of average of leaf roll incidence (16.45%) and mean of average of total viral disease incidence (36.10%) on Kufri Pokheraj in Samastipur district and mean of average of mosaic incidence (9.29%) mean of average of leaf roll incidence (8.27%) and mean of average of total viral disease incidence (17.56%) on Kufri Pokheraj in Begusarai district were recorded more compared to mean of average mosaic incidence (8.59%), mean of average of leaf roll incidence (8.18%) and mean of average of total viral disease incidence (16.77%) on Kufri Jyoti in Samastipur district and mean of average of mosaic incidence (5.89%), mean of average of total

viral disease incidence (11.33%) on Kufri Jyoti in Begusarai district.

The results revealed that average of mosaic incidence, average of leaf roll incidence and average of total viral disease incidence were higher on cv Kufri Pokheraj than on Kufri Jyoti in both the districts, which may be due to higher susceptibility of cv Kufri Pokheraj to the common viruses while the cv Kufri Jyoti reported tolerance to some viruses and has slow rate of degeneration [6].The results also revealed that the mosaic incidence, leaf roll incidence and total viral incidence in both the varieties were more in the potato fields of Samastipur as compared to Begusarai district, might be due to non-availability of virus free seed and farmers in the absence of availability of quality seed bound to use same seed stocks year after year in surveyed blocks of Samastipur district where as quality potato seed was made available to the farmers of surveyed blocks of Begusarai district through quality potato seed production program by integrated efforts of CPRI Patna, KVK Begusarai and Shaligram Bhushari Farmers Foundation, Korjana, Begusarai. The period of field exposure of seed stocks of potato varieties reacted with different degrees of viral disease incidence and loss in tuber yield [7, 8]. The present survey study also reflects the need of local product of quality potato seed because potato is vegetative propagated crop, 2.5 to 3 tonnes of seed is required for a hectare resulting in about 50% cost of cultivation [9, 10]. The observations recorded under the course of study are also relevant for identifying locations with low aphid pressure for minimum degeneration of seed stocks for multiplying seed of potato crops and also for identifying the suitable varieties which can withstand degeneration due to infection / accumulation of common viruses.

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