

Evaluation of Some Certified Potato Seed Varieties Against PVY and PLRV Infection in Six Farms/Zones of Bangladesh

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Abstract: Potato is a very popular tuberous vegetable crop in Bangladesh but its production is greatly hampered by lacking of quality seeds. An experiment was performed to evaluate the quality of certified seed potatoes against *Potato virus Y* (PVY) and *Potato leaf roll virus* (PLRV) on different seed potato varieties (Asterix, Cardinal, Diamant and Granula) cultivated in Bangladesh. Foundation and TLS (Truthfully leveled seed) seed potatoes were produced in six different seed production farms/zones (Nilphamari, Domar, Nashipur, Madupur, Dattanagar and Amla) of BADC were tested for PVY and PLRV infection level. The infection level of both viruses in almost all supplied samples of both Foundation and TLS Class seed potatoes were found beyond the acceptable limit. However, the incidences of the two viruses were found to be varied in accordance to seed production zones/farms and tested varieties. Variety Asterix and Diamant are more tolerant than Cardinal and Granula. Domar and Nilphamary farms are better zones for quality foundation seed production while Thakurgaon & Nashipur zones are better for quality TLS seed potato production.

Key words: *Solanum tuberosum* • Virus • Foundation seed and TLS class seed

INTRODUCTION

Potato (*Solanum tuberosum* L.) is among the four most important global crops [1] which positioned at second after cereals. Lack of availability of affordable high quality seed potatoes is the main constraint to potato production in Bangladesh. Uses of quality seed can contribute up to a great extend to boost up crop production. Thus production and availability of quality seed is very important and that's why the government has recently given the seed sector a 'Topmost Priority' status. Nowadays, viral diseases are the most alarming factors for vegetable cultivation in Bangladesh. Though it is relieving to all crop growers that most of the plant viruses

are not seed-borne but it got futile in case of potatoes as it is propagated vegetatively through tubers. Vegetative propagation in potatoes is the cause of varietal degenerescence, once seed tubers from infected mother plants may carry viruses. Worldwide potato crop is infected by more than 36 viruses and viroid [2, 3]. The lamentable poor yield of potato in our country is mostly attributed to the poor quality of seed potatoes mainly due to degeneration as a direct consequence of a buildup of viral pathogens specially PVY and PLRV. About 40 viruses are known to infect cultivated potatoes [4] PVY ranked 5th based on scientific/economic importance [5] among all plant viruses Bangladesh Agricultural Development Corporation (BADC) is trying to produce

virus free seed potato [6] following a standard method of producing quality seeds for farmers which involved re-foundation seed, foundation seed, certified seed-I, and certified seed-II [7]. Qualities of BADC seed potatoes are not beyond questioned. A solution to these disease problems would result into increased certified seed, ware potato yields per unit area and an expansion of seed and ware potato acreage. The PVY and PLRV and their vector aphids are the key constraints to production of certified seed potatoes and constitute an important yield constraint. Potato cultivation is expanding with increasing year round demand in Bangladesh, problems associated with devastating viral diseases need to be addressed. This first nation-wide survey was mainly aimed at elucidating the presence and distribution of the aphid transmitted PVY and PLRV. These viruses are traditionally thought as the most prevalent and harmful in potato production and they are monitored consistently in systems of certified potato seed production [8]. Present experiment was conducted to assess the quality status in respect of PVY and PLRV infection of different generations of certified seed potatoes grown by BADC at different Zones and Farms of Bangladesh.

MATERIALS AND METHODS

The experiment was conducted at Tissue Culture Laboratory of Bangladesh Agricultural Development Corporation (BADC), Kashimpur and Plant Pathology Laboratory of BSMRAU, Gazipur during winter 2010-11, 2011-12 and 2012-13 cropping seasons. The DAS-ELISA was performed to detect the PVY and PLRV infection on Foundation and TLS (Truthfully leveled seed) class seed potatoes of 6 different farms and 6 different of BADC, respectively. Seed potato samples of four popularly cultivated varieties namely Asterix, Cardinal, Diamant and Granula were collected from six different seed potato zones and farms of BADC. Foundation seed potato samples were collected from Nilphamari, Domar, Nashipur, Madupur, Dattanagar and Amla farms. Whereas, TLS seed potato samples were collected from Bogra, Thakurgaon, Nashipur, Jamalpur, Rangpur and Rajshahi zones/farms. Twenty four samples of every four lots of each zone/farm containing randomly selected 100 seed potato tubers per lot of each potato varieties were brought in to the laboratory and kept under defused light for sprouting to perform DAS-ELISA (Double Antibody Sandwich Enzyme-Linked Immunosorbent Assay) [19].

Disease incidence was calculated by the standard formula:

$$\text{Disease incidence} = \frac{\text{Number of virus affected tubers}}{\text{Total tubers in the lot}} \times 100$$

The data were analyzed following 4 (Variety) \times 6 (Zone/farm) \times 3 (Virus infection level) factorial experiment in RCBD with 4 (Lot) replications. The data were analyzed using STATISTIX10 software. Before analysis, data were transformed following arcsine transformation. Mean separation was performed through Tukey's Honestly Significance Difference Test (THSDT).

RESULTS

Incidence of PVY on Foundation Seed Potatoes: Maximum incidence of virus was in seed tubers from Madhupur farm which was statistically similar with Amla, Dattanagar and Nashipur Farms (2.79, 2.66) while minimum incidence was found from Domar farm (1.60%) followed by Nilphamari farm. Considering all locations, maximum PVY infection was found in Cardinal variety (5.35) followed by Granula (3.99), Diamant (2.39) and Asterix (2.66). However, in case of cardinal variety, maximum PVY incidence was recorded from Madhupur farm (7.18%) and minimum from Domar farm (2.40%). Similar trends were also observed in case other varieties except Asterix and Diamant where highest incidence found in the samples of Dattanagar farm (Table 1).

Incidence of PLRV on Foundation Seed Potatoes: The highest prevalence of PLRV was detected from seed potato samples of Madhupur farm (5.32%) in Cardinal. While lowest infection of virus in same variety recorded from Domar farm (1.06%). In case of Granula, the highest prevalence of PLRV observed in Madhupur and lowest from Domar followed by Nashipur and Dattanagar farm. Almost similar trends also observed in case of other varieties except Asterix where highest incidence of PLRV recorded from the samples of Amla farm (Table 2). Among the varieties, PLRV prevalence was highest in Cardinal followed by Granula and Asterix while the variety Diamant had lowest infection. Among the six farms, the lowest incidence of the virus was recorded from the samples of Domar farm which was statistically similar with Nilphamari, Nashipur and Dattanagar but differ from the samples of Amla farm that yielded the highest PLRV incidence.

Table 1: Incidence of Potato virus Y (PVY) on Foundation Class Seed Potatoes of four potato varieties grown in six different farms of BADC growing in 2010-11 season

Incidence of PVY on Foundation class seed potatoes*					
Zone/Farm	Asterix	Cardinal	Diamant	Granula	Mean
Nilphamari	1.86 b (0.019)	2.93 ab (0.030)	1.86 b (0.019)	2.66 ab (0.028)	2.33 ab
Domar	1.06 b (0.012)	2.40 b (0.025)	1.86 b (0.014)	1.60 b (0.018)	1.60 b
Nashipur	1.86 b (0.019)	3.73 ab (0.037)	2.39 b (0.024)	2.66 ab (0.028)	2.66 ab
Madhupur	1.86 b (0.019)	7.18 a (0.072)	1.86 b (0.019)	3.99 ab (0.041)	3.72 a
Dattanagar	2.66 ab (0.027)	2.93 ab (0.029)	2.39 b (0.024)	3.19 ab (0.033)	2.79 ab
Amla	2.13 b (0.021)	5.35 ab (0.054)	2.39 b (0.024)	2.93 ab (0.030)	3.20 ab
Variety mean	1.91 b	4.08 a	2.04 b	2.84 ab	4.38

* Values with same letters within rows and columns are not significantly (p = 0.05) different. Figures within parenthesis indicate the arcsine transformed value

Table 2: Incidence of Potato leaf roll virus (PLRV) on Foundation Class Seed Potatoes of four potato varieties grown in six different farms of BADC growing in 2010-11 season

Incidence of PLRV on Foundation class seed potatoes*					
Zone/Farm	Asterix	Cardinal	Diamant	Granula	Mean
Nilphamari	0.53 b (0.007)	2.13 ab (0.022)	0.80 b (0.010)	2.39 ab (0.024)	1.46 bc
Domar	0.80 b (0.010)	1.06 b (0.012)	0.53 b (0.007)	1.60 b (0.017)	1.00 c
Nashipur	1.06 b (0.012)	2.13 ab (0.022)	1.60 b (0.017)	1.60 b (0.017)	1.60 abc
Madhupur	0.80 b (0.010)	5.32 a (0.053)	1.60 b (0.016)	3.44 ab (0.035)	2.79 a
Dattanagar	1.86 b (0.019)	2.13 ab (0.022)	1.06 b (0.012)	2.66 ab (0.027)	1.93 abc
Amla	2.13 b (0.021)	3.19 ab (0.032)	1.33 b (0.014)	2.93 ab (0.029)	2.39 ab
Variety mean	1.20 b	2.66 a	1.15 b	2.44 a	1.86

* Values with same letters within rows and columns are not significantly (p = 0.05) different. Figures within parenthesis indicate the arcsine transformed value

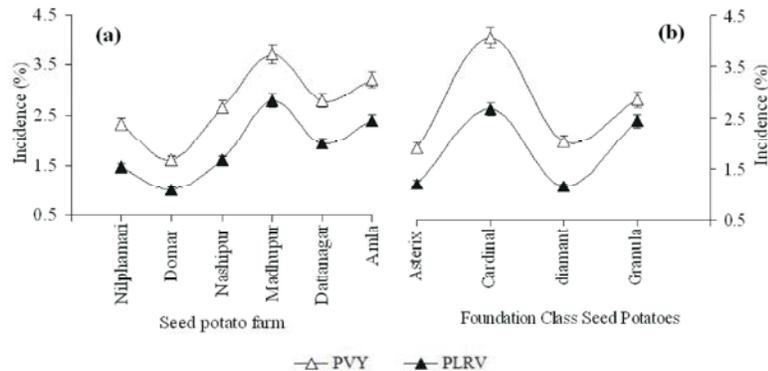


Fig. 1: Incidence of Potato virus Y (PVY) & Potato leaf roll virus (PLRV) on Foundation Class Seed Potatoes of four potato varieties (A) grown in six different farms (B) of BADC in 2010-11 seasons.

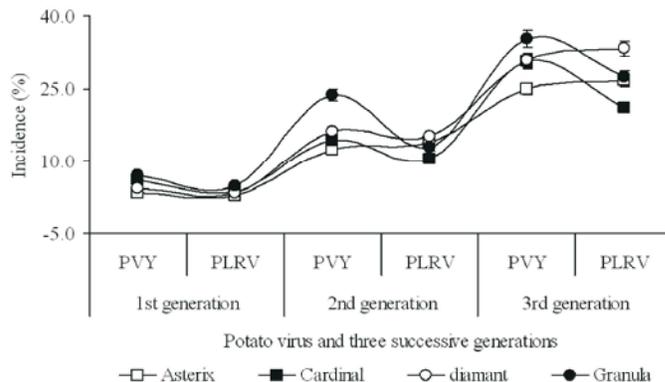


Fig. 2: Incidence of *Potato virus Y* (PVY) & *Potato leaf roll virus* (PLRV) on TLS Class Seed Potatoes of four

The results shown in the Fig. 1 and Fig. 2 revealed that, irrespective of varieties and farms PVY is more prevalent than PLRV. Variety Asterix and Diamant are more tolerant than Cardinal and Granula. Domar and Nilphamari farms are better than that of other farms in respect of quality foundation seed potato production.

Total Incidence of PVY & PLRV on Foundation Seed Potatoes: Total incidence of PVY and PLRV in the six foundation seed potato production farms of BADC during 2010-11 cropping season is presented in Table 3. The less prevalent of the two viruses were recorded from Domar farm which was statistically similar with the Nilphamari and Nashipur farms but differed from Dattanagar and Amla farms, while Dattanagar yielded the highest virus infected potatoes. Considering all varieties, the highest virus incidence was detected from the variety Cardinal followed by Granula, Asterix and Diamant. In case of Asterix, the highest incidence was recorded from Dattanagar farm and lowest incidence from Domar farm. But in case of Cardinal, the highest incidence was detected from Madhupur farm that was followed by Amla, Nashipur and Dattanagar farms and the lowest incidence was recorded from Domar farm. Almost similar trends also observed in case of variety Granula and Diamant (Table 3).

Incidence of PVY on TLS Seed Potatoes: The results of DAS-ELISA on TLS seed potatoes of four potato varieties from six different farms of BADC revealed that PVY was prevalent in all the supplied samples of 2010-11, 2011-12 and 2012-13 potato seasons (3 generations) (Table 4). From the results it becomes evident that the PVY infection increased remarkably with the increase of generation. The infection increased more than 3 fold from 1st to 2nd generation and almost 6 fold from 1st to 3rd generations. In case of first generations, the lowest incidence of PVY was recorded from the variety Asterix in all the samples of six seed potato zones except Jamalpur where variety Diamant performed better considering the lowest PVY incidence. In most of the cases the highest incidence of the virus was detected from the seed potato samples of Granula followed by Cardinal and Diamant. Almost similar trends also observed in case of 2nd generation. In case of 3rd generation, the highest incidence of PVY was recorded from the variety Granula and the lowest incidence was recorded from Asterix in all the six seed potato zones. In considering seed potato zones Nashipur performed the best followed by Thakurgaon, Bogra, Rangpur and Rajshahi in considering healthy TLS seed potato production (Table 4).

Incidence of PLRV on TLS Seed Potatoes: The results of DAS-ELISA on TLS seed potatoes of four potato varieties from six different farms of BADC revealed that PLRV was prevalent in all the supplied samples of the all the three successive generations (Table 5). From the results it becomes evident that the PLRV infection tremendously increased with the increase of generation. The infection increased more than 3 fold from 1st to 2nd generation and more than 7 fold from 1st to 3rd generations. In case of first generations the lowest incidence of PLRV was recorded from the variety Asterix in all the samples of six seed potato zones and there were no significance different among the zones. And in most of the cases the highest incidence of the virus was detected from Cardinal and Granula varieties. In case of 2nd generation, the highest incidence of PLRV was recorded from the variety Diamant and most of the cases that was followed by Asterix and Cardinal. Almost similar trends were observed in case of 3rd generation seed potato samples. In considering seed potato zones Nashipur and Thakurgaon performed better than that of Rangpur, Jamalpur, Bogra and Rajshahi though the statistical difference among the zones were almost negligible (Table 5).

The results shown in the Fig. 2 and Fig. 3 revealed that, irrespective of varieties and farms PVY is more prevalent than PLRV. The rate of quality deterioration is increased with the increased of generation. Variety Asterix and Diamant are more tolerant than Cardinal and Granula. Nashipur, Thakurgaon and Bogra farms are better than that of other farms in respect of quality TLS seed potato production.

Total Incidence of PVY & PLRV on TLS Seed Potatoes: Considering total incidence of the two tenacious viruses, all samples of TLS seed potatoes of 2010-11 were found infected in all the six different regions and the deterioration was increased manifold with the increase of generations. However, in 1st generation, the lowest incidence of the viruses was recorded from Asterix and the highest incidence was recorded from Granula followed by Cardinal and Diamant in all the six seed potato zones. In case of 2nd generations, the highest incidence of both the viruses was recorded from Granula and the lowest from the variety Cardinal. In case of 3rd generations, Granula also showed most susceptibility considering the virus prevalence and that was followed by Diamant, Cardinal and Asterix with little exception in case of Bogra and Rangpur zones where lowest infection recorded from Cardinal. Considering all the varieties, Thakurgaon zone performed better followed by Nashipur, Bogra, Rangpur, Jamalpur and Rajshahi in considering healthy TLS seed potato production (Table 6).

Table 3: Total incidence of PVY and PLRV on Foundation Class Seed Potatoes of four potato varieties grown in six different farms of BADC growing in 2010-11 season

Total incidence of PVY & PLRV on Foundation class seed potatoes*					
Zone/Farm	Asterix	Cardinal	Diamant	Granula	Mean
Nilphamari	2.39 bc (0.024)	5.05 bc (0.051)	2.66 bc (0.027)	5.05 bc (0.051)	3.79 bc
Domar	1.86 c (0.019)	3.46 bc (0.036)	1.86 c (0.019)	3.19 bc (0.033)	2.59 c
Nashipur	2.93 bc (0.029)	5.85 bc (0.059)	3.99 bc (0.040)	4.26 bc (0.043)	4.26 abc
Madhupur	2.66 bc (0.027)	12.50 a (0.126)	3.46 bc (0.035)	7.43 abc (0.075)	4.72 abc
Dattanagar	4.52 bc (0.045)	5.05 bc (0.051)	3.46 bc (0.035)	5.85 bc (0.059)	6.51 a
Amla	4.26 bc (0.043)	8.54 ab (0.086)	3.72 bc (0.037)	5.85 bc (0.059)	5.59 ab
Variety mean	3.10 b	6.74 a	3.19 b	5.27 a	4.58

* Values with same letters within rows and columns are not significantly ($p = 0.05$) different. Figures within parenthesis indicate the arcsine transformed value.

Table 4: Incidence of *Potato virus Y* (PVY) on TLS Class Seed Potatoes of four potato varieties grown in six different zone/farms of BADC at three successive years (2011-13)

Incidence of PVY on TLS class seed potatoes*					
Zone/Farm	Variety	1 st generation 2010-11	2 nd generation 2011-12	3 rd generation 2012-13	Mean
Bogra	Asterix	3.68 rs (0.037)	12.50 j-q (0.125)	24.20 d-g (0.245)	13.46 fg
	Cardinal	6.92 l-s (0.69)	14.36 j-n (0.144)	28.72 a-e (0.291)	16.67 d-g
	Diamant	4.26 qrs (0.043)	15.69 h-k (0.158)	28.99 a-e (0.294)	16.31 d-g
	Granula	7.71 k-s (0.077)	23.14 e-i (0.233)	36.702 a (0.376)	22.52 a
Thakurgaon	Asterix	2.88 s (0.029)	11.70 j-r (0.117)	23.94 d-h (0.242)	12.84 g
	Cardinal	5.59 o-s (0.056)	13.57 j-o (0.136)	31.12 a-e (0.317)	16.76 d-g
	Diamant	4.26 qrs (0.043)	15.43 ijk (0.155)	31.12 a-e (0.311)	16.76 d-g
	Granula	6.91 l-s (0.069)	23.94 d-h (0.242)	35.902 ab (0.368)	22.25 ab
Nashipur	Asterix	2.76 s (0.029)	11.67 j-r (0.117)	23.88 d-h (0.241)	12.77 g
	Cardinal	5.67 o-s (0.056)	13.67 j-o (0.136)	31.17 a-e (0.317)	16.83 d-g
	Diamant	4.27 qrs (0.043)	15.33 ijk (0.155)	29.94 a-e (0.301)	16.51 d-g
	Granula	6.93 l-s (0.069)	23.94 d-h (0.242)	33.25 ab (0.368)	21.37 ab
Jamalpur	Asterix	3.94 rs (0.040)	12.50 j-q (0.125)	24.20 d-g (0.245)	13.55 fg
	Cardinal	6.65 m-s (0.067)	15.16 i-l (0.152)	34.05 ab (0.348)	18.62 a-d
	Diamant	3.73 rs (0.037)	17.02 g-j (0.171)	33.25 abc (0.339)	18.00 cde
	Granula	7.45 k-s (0.075)	24.20 d-g (0.244)	36.44 a (0.374)	22.69 a
Rangpur	Asterix	3.68 rs (0.037)	13.83 j-o (0.139)	27.93 b-e (0.283)	15.14 d-g
	Cardinal	6.92 l-s (0.069)	14.36 j-n (0.144)	28.72 a-e (0.291)	16.67 d-g
	Diamant	4.79 p-s (0.048)	14.89 i-m (0.149)	31.39 a-d (0.319)	17.02 def
	Granula	6.38 n-s (0.064)	23.14 e-i (0.234)	36.44 a (0.374)	21.99 abc
Rajshahi	Asterix	3.68 rs (0.037)	12.78 j-p (0.128)	25.80 c-f (0.261)	14.08 efg
	Cardinal	6.38 n-s (0.064)	14.90 i-m (0.150)	30.85 a-e (0.314)	17.38 def
	Diamant	4.52 p-s (0.045)	18.35 f-j (0.185)	31.91 a-d (0.325)	18.26 bed
	Granula	6.65 m-s (0.067)	24.74 d-g (0.250)	35.64 ab (0.365)	22.34 ab
Mean		5.28 c	16.70 b	30.54 a	17.51

* Values with same letters within rows and columns are not significantly ($p = 0.05$) different. Figures within parenthesis indicate the arcsine transformed value

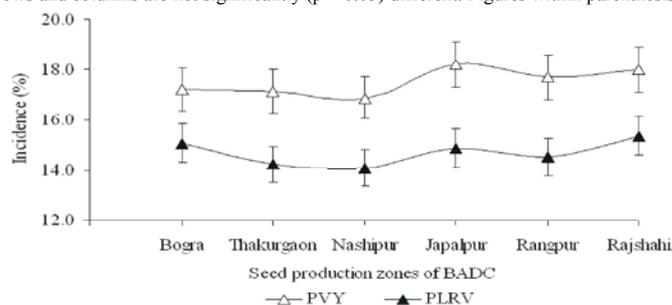


Fig. 3: Incidence of *Potato virus Y* (PVY) & *Potato leaf roll virus* (PLRV) on TLS Class Seed Potatoes of four potato varieties grown in six different zones of BADC

Table 5: Incidence of *Potato leafroll virus* (PLRV) on TLS Class Seed Potatoes of four potato varieties grown in six different zone/farms of BADC at three successive years (2011-13)

Zone/Farm	Variety	Incidence of PVY on TLS class seed potatoes*			
		1 st generation 2010-11	2 nd generation 2011-12	3 rd generation 2012-13	Mean
Bogra	Asterix	2.93 q (0.029)	14.63 jkl (0.147)	26.33 c-h (0.266)	14.63 a-e
	Cardinal	3.73 opq (0.037)	10.11 l-p (0.101)	20.22 h-k (0.204)	13.56 b-e
	Diamant	3.73 opq (0.037)	15.43 i-l (0.155)	32.71 a-d (0.333)	17.29 a
	Granula	5.32 m-q (0.053)	13.03 l (0.131)	26.07 d-h (0.264)	14.81 abc
Thakurgaon	Asterix	2.93 q (0.029)	13.03 l (0.131)	24.73 e-h (0.250)	13.56 b-e
	Cardinal	3.19 pq (0.032)	10.37 l-o (0.104)	20.48 g-j (0.206)	11.35 de
	Diamant	3.46 opq (0.035)	14.36 jkl (0.144)	32.99 abc (0.336)	16.93 ab
	Granula	4.79 n-q (0.048)	12.24 lm (0.123)	28.19 a-f (0.286)	15.07 abc
Nashipur	Asterix	2.85 q (0.029)	12.13 l (0.121)	24.67 e-h (0.250)	13.22 b-e
	Cardinal	3.18 pq (0.032)	10.17 l-o (0.104)	20.33 g-j (0.206)	11.22 de
	Diamant	3.56 opq (0.036)	14.33 jkl (0.144)	32.87 abc (0.336)	16.92 ab
	Granula	4.67 n-q (0.047)	12.24 lm (0.123)	28.21 a-f (0.286)	15.04 abc
Jamalpur	Asterix	2.66 q (0.027)	14.89 jkl (0.150)	27.39 b-f (0.278)	14.98 abc
	Cardinal	4.52 n-q (0.045)	11.44 lmn (0.115)	22.87 e-h (0.231)	11.94 cde
	Diamant	3.19 pq (0.032)	15.43 i-l (0.155)	33.25 ab (0.339)	17.29 a
	Granula	4.26 opq (0.043)	13.30 kl (0.134)	28.19 a-f (0.286)	15.25 abc
Rangpur	Asterix	2.93 q (0.029)	13.30 l (0.133)	28.19 a-f (0.286)	14.80 a-d
	Cardinal	3.46 opq (0.035)	10.11 l-p (0.101)	20.22 h-k (0.204)	11.26 e
	Diamant	3.19 pq (0.032)	15.16 jkl (0.152)	33.24 ab (0.339)	17.20 a
	Granula	4.52 n-q (0.045)	12.77 l (0.128)	27.13 b-g (0.275)	14.81 abc
Rajshahi	Asterix	2.93 q (0.030)	15.16 jkl (0.152)	28.99 a-e (0.294)	15.69 abc
	Cardinal	4.26 opq (0.043)	11.44 lmn (0.115)	22.07 f-l (0.223)	12.59 ede
	Diamant	3.46 opq (0.035)	15.96 i-l (0.160)	34.58 a (0.354)	18.00 a
	Granula	4.79 n-q (0.048)	14.10 jkl (0.141)	26.60 b-h (0.269)	15.16 abc
Variety mean	3.69 c	13.13 b	27.11 a	14.64	

* Values with same letters within rows and columns are not significantly ($p = 0.05$) different. Figures within parenthesis indicate the arcsine transformed value.

Table 6: Total incidence of PVY and PLRV on TLS Class Seed Potatoes of four potato varieties grown in six different zone/farms of BADC at three successive years (2011-13)

Zone/Farm	Variety	Incidence of PVY on TLS class seed potatoes*			
		1 st generation 2010-11	2 nd generation 2011-12	3 rd generation 2012-13	Mean
Bogra	Asterix	6.38 n (0.064)	27.39 hi (0.278)	50.53 ef (0.532)	28.10 c
	Cardinal	9.31 n (0.093)	24.47 i-l (0.247)	48.94 ef (0.512)	27.57 c
	Diamant	7.98 n (0.080)	31.12 hi (0.317)	54.79 a-e (0.581)	31.29 bc
	Granula	13.03 j-n (0.131)	36.17 g-i (0.370)	62.77 a-c (0.679)	37.32 ab
Thakurgaon	Asterix	5.32 n (0.053)	25.80 h-j (0.271)	48.67 c-e (0.543)	26.60 c
	Cardinal	8.78 n (0.088)	23.94 i-m (0.242)	51.60 c-e (0.543)	28.10 c
	Diamant	7.71 n (0.078)	29.79 hi (0.303)	56.92 a-e (0.608)	31.47 a-c
	Granula	11.70 k-n (0.117)	34.04 hi (0.348)	64.10 a (0.698)	36.61 ab
Nashipur	Asterix	5.61 n (0.056)	23.80 i-l (0.241)	48.55 e-g (0.509)	25.99 c
	Cardinal	8.85 n (0.089)	23.84 i-m (0.242)	51.50 c-e (0.543)	28.06 c
	Diamant	7.83 n (0.078)	29.66 hi (0.303)	62.81 a-c (0.608)	33.43 a-c
	Granula	11.60 k-n (0.117)	36.18 g-i (0.370)	61.84 a-d (0.660)	36.54 ab
Jamalpur	Asterix	7.18 n (0.072)	25.00 i-k (0.253)	51.60 c-e (0.544)	27.93 c
	Cardinal	10.11 n (0.101)	25.00 i-k (0.253)	56.12 a-e (0.597)	30.41 c
	Diamant	6.91 n (0.069)	30.50 hi (0.310)	58.51 a-e (0.631)	31.97 a-c
	Granula	11.70 k-n (0.117)	34.00 hi (0.347)	64.63 ab (0.691)	36.78 ab
Rangpur	Asterix	5.59 n (0.056)	27.13 hi (0.275)	56.12 a-e (0.596)	29.61 c
	Cardinal	10.11 mn (0.102)	24.47 i-l (0.247)	48.94 ef (0.512)	27.84 c
	Diamant	7.98 n (0.080)	30.05 hi (0.305)	57.45 a-e (0.616)	31.83 a-c
	Granula	10.90 l-n (0.109)	35.91 hi (0.368)	63.57 a (0.705)	36.79 ab
Rajshahi	Asterix	6.39 n (0.064)	27.66 hi (0.280)	51.07 d-f (0.537)	28.37 c
	Cardinal	10.64 l-n (0.107)	26.33 hij (0.267)	52.93 b-e (0.558)	29.96 c
	Diamant	7.98 n (0.080)	31.38 hi (0.320)	56.12 a-e (0.598)	31.83 a-c
	Granula	11.44 k-n (0.115)	38.83 f-h (0.399)	62.24 a-d (0.673)	37.50 a
Variety mean	8.67 c	29.27 b	55.93 c	31.29	

* Values with same letters within rows and columns are not significantly ($p = 0.05$) different. Figures within parenthesis indicate the arcsine transformed value

DISCUSSION

The results of the present study suggested that PVY and PLRV free quality seed potato production remarkably depended upon the selection of farms/zones where condition is favorable. These finding also are of conformity with the findings of Burhan *et al.* [9]. Moniruzzaman *et al.* [10] tried to functional analyzed of quality seed among the three seed tuber producing zones of BADC. Variations in the relative prevalence of viruses in potato seed tubers with different zones can be explained by the factors determining virus infection and spread in the locations where the tubers were harvested [11]. Composition of aphid fauna [12] and their host preferences [13, 14] may affect PVY spread in the field. The incidence of PVY was much more than PLRV in the current study and the possible reason may be PVY transmitted in non-persistent way and PLRV in persistent way [15]. The PVY and PLRV incidence varied according to the different zones/farm due to the environmental conditions such as temperature, relative humidity. Relative humidity had a negative effect on aphid population build up in field [15, 16, 17]. Different percentages of disease incidence of PVY and PLRV were also investigated in different areas of Pakistan [18]. In Bangladesh, virus infections seem to be detrimental for the domestic ware and seed potato industry. The use of virus-free seed tubers to get higher yield of the crop has been known for a long time to be of major importance. The improvement of domestic certified seed potato production schemes will also have an increas impact in the development of efficient production systems.

CONCLUSION

The results of DAS-ELISA on foundation seed potatoes of four potato varieties from 6 different farms of BADC revealed that the PVY and PLRV were prevalent in almost all the supplied samples 2010-11 potato seasons. However, the incidence of the two viruses was found to be varied in accordance to seed production farms and tested varieties. BADC produced potato seed were not crossed to the acceptable limit to the incidence of PVY and PLRV. Among the varieties Asterix and Diamant was found to be more tolerant. It could be suggested that it is better to produce foundation seed potato in Domar and Nilphamary farms and TLS seed potato in Thakurgaon and Nashipur farms.

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