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Short Communication

Disease free seed potato production through seed plot technique at farmers' level in Bangladesh

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Among the reasons for the low yield of potato in Bangladesh, lack of disease free quality seed tubers, lack of improved varieties/ practices and disease problems are noticeable (4). The total seed potato requirement of Bangladesh is estimated at about 7.50 lakh tons per annum. Locally produced certified seed meets about 6% of the total requirement (10). Every year about 10,000 tons of potato seeds are being imported with a very high expense of foreign currency. Farmers, traders or cold storage owners supply the remaining seed. The cost of good quality planting materials produced and sold by the Bangladesh Agricultural Development Corporation (BADC) and private farms are beyond the reach of poor farmers. Therefore, the farmers are forced to acquire poor quality seed from the informal system. In the seed plot technique (SPT), disease free potato seed tuber (whole tuber), early planting, maintaining isolation distance by planning non host (wheat) surrounding the seed plot, use of HYV disease resistant varieties, roughing diseased plant at 30-45 days after planting (DAP), spraying insecticide (Admire) for vector control, spraying fungicides to minimize fungal diseases, weeding, other improve management, haulm pulling at 80DAP, harvesting, sorting, grading, seed treating with boric acid (3%) and storing at cold store found most effective in producing disease free seed potatoes at farmers' field at different locations (2). Efforts to increase the quality of planting materials, production techniques in the informal system will help the resource poor farmers by making available quality planting material, higher yields and finally alleviate poverty. Hence, farmers' field trials was undertaken to improve the informal seed system in potato seed growing areas of Bangladesh, and to provide farmers with an alternative source for quality planting materials at a reasonable price.

Farmers' field trials were conducted at 22 districts of Bangladesh with the participation of Department of Agricultural Extension (DAE) field Officers under the supervision of Tuber Crops Research Centre (TCRC) and On-Farm Research Division (OFRD) Scientists of Bangladesh Agricultural Research Institute (BARI). Each of the farmer field trial was 10 decimal of plot with one potato variety Diamant/Granola/ Cardinal/Provento/Asterix. In some locations, field supervisors and farmers were trained before and during the crop season on improved seed production techniques as well as integrated disease management (IDM) practices. Disease free foundation seed includes variety *viz.* Diamant, Granola, Provento, Cardianal, Asterix were planted

during the 4th quarter of November to 1st quarter of December and the crop was de-haulmed 80 DAP. SPT was followed in the trials where tubers were planted with 60cm x 25cm spacing and individual plot size was 5.0m X 3.0m. Fertilizers were applied @ 350 kg Urea, 220 kg TSP, 260 kg MP, 120 kg Gypsum, 14 kg $ZnSO_4$, and 6 kg Boric Acid per hectare. Half of urea and full dose of other fertilizers were applied immediately before planting the seed in furrows and mixed properly with the soil. The rest of the urea was side-dressed at 35 DAP. Irrigation, weeding, earthing-up and other intercultural operations were done as and when necessary for raising a good crop. Acrobat MZ and Secure (fungicides) were sprayed to control diseases and Admire (insecticide) was sprayed to control insects. At the time of final land preparation, Bisteren 5G (insecticide) was applied to the soil against cutworm and other soil pests. In farmers' practice, the spacing followed was 40cm between the lines and 10-15cm between the plants. Fertilizers were used @ 300-300-300 kg/ha of Urea, TSP and MP, respectively. All the fertilizers were applied during final land preparation. Farmers used cut-seed tubers with or without mulch that varied in different locations. Diseases and yield data were recorded. Rouging of diseased plants was done in the SPT for at least two times; one at 30-35 DAP and other at 40-50 DAP. Data on number of rouged out plants, diseases and yield were also recorded.

The results obtained from the field trials in 2009-2010 and 2010-2011 are presented in the Table 1. From the table, it was observed that all the varieties produced almost similar tuber yield through improved practice comparing to farmers' practice.

Regarding disease incidence, the highest pressure of different diseases was observed in the farmers' managed plots over researchers' plots (Table 1). In SPT, no bacterial wilt, late blight and black scurf diseases were found while in farmers' practice only late blight disease was absent. Virus infection was also relatively higher in the farmers' practice (5.9%) as compared to SPT (0.3). In case of scab disease, the highest per cent (5.9% by weight) of tubers were infected by the scab pathogen in farmers' plot and it was very low (1.4 % by weight) in SPT. Results on widespread field trials across the country are presented in Table 2. Table shows that SPT is very effective for production of quality seed tuber of potato. On an average, the variety Diamant yielded highest (28.16 t/ha) followed by Asterix (27.66t/ha), Granola (26.59t/ha), Cardinal (25.45t/ha) and Provento (23.21 t/ha).

Incidence of virus, bacteria, common scab and late blight were very low neigbouring plot of SPT as compared to farmers practice. The mean percent of virus infection was very low (0.89%) irrespective of varieties (Table 3). It was also observed that average scab infection average, late blight infection 7.36% and 2.13%, respectively. The incidence of cutworm was also very low (1.60%). The variety, Diamant produced highest average tuber yield (28.16 t/ha), followed by Asterix 27.66 t/ha,

Granola (26.59 t/ha), Provento (25.45 t/ha) and Cardinal (23.21 t/ha).

Incidence of diseases in subsequent generations in seed potatoes from seed plot techniques are presented in Table 4. In second generation, highest percentage of scab (2.3%) was recorded followed by viruses (0.8%) but no bacterial wilt or black scurf was observed. In third generation, disease pressure was slightly increased and highest incidence of scab (4.9%) followed by viruses (3.1%), bacterial wilt (1.2%) and black scurf (0.8).

On an average, although, yield was somehow lower in improved practice but quality of plants and seed tubers were much better in improved practice than farmers' practice. Similar observations were also reported earlier (4, 5, 6).

No late blight incidence in the farmers plot was recorded and this might be due to the increased consciousness of farmers about late blight management. Further, they advocates spray schedules to manage late blight prior to the appearance of the disease. Similar statement was also made by Dey *et al.* (3). Higher virus infection in the farmers' practice was probably due to lack of awareness of the farmers about aphid which is primarily responsible for virus transmission (1). In case of scab, low incidence in SPT was due to treatment of tubers by 3% boric acid before planting. Similar trend of high disease incidence in farmers managed trials was also reported by others (8).

Widespread field trials across the country showed satisfactory performance of Diamant, a most popular variety in Bangladesh especially in the Munshiganj district; contributes about one-seventh of total production of the country. Therefore, farmers are much aware about the quality seeds of Diamant. Incidence of virus, bacteria, common scab and late blight were very low compared to farmers' practice at neighbor plots. This might be due to spray of insecticide or fungicides in the SPT. However, most of the farmers including participating ones showed very positive response to introduction of potato seed production programme under SPT in order to produce quality seed tuber in their field for their own use. Earlier results showed that the farmers harvested average yield of 30 t/ha with very low percent of virus (0.42%) and scab infection (7.0%) (7,9,10). It was also observed that in the subsequent two generations from the same seed source following SPT, disease incidence were very low and even in third generations without much loss of yield (2). In case of incidence of diseases in subsequent generations in seed potatoes from SPT, it was observed that disease pressure increased with the increase of generation. Increased disease pressure in the subsequent generations might be due to lack of rigorous spray schedule by the farmers.

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Table 1.

Infestation of different diseases in seed plot techniques and farmers' plots at Munshiganj (average of 3 years trials)

Disease	Seed plot technique	Farmers' practice
Average yield (t/ha)	31.7	31.9
Wilt (% plant)	nil	1.9
Late blight(% plant)	nil	nil
Virus (% plant)	0.3	5.9
Scab (% wt)	1.4	5.9
Rhizoctonia /Black scurf (%)	nil	0.5

Table 2.

Tuber yield of potato in the informal seed system trials at different locations of Bangladesh conducted during 2009-10 to 2010-11

Location	Yield (t/ha)				
	Asterix	**Diamant**	**Cardinal**	**Granola**	**Provento**
Munshiganj (10)*	33.24	31.53	-	28.65	-
Comilla (12)	-	30.99	28.16	27.23	-
Chandpur (3)	29.78	37.64	-	-	30.32
Chittagong (10)	-	27.92	-	23.54	-
Jessore (10)	25.43	29.88	28.67	-	-
Jamalpur (9)	29.62	28.16	-	33.88	-
Sheerpur (11)	-	31.20	-	28.04	-
Rangpur (13)	28.71	-	23.31	26.41	-
Rajshahi (10)	-	27.38	-	-	-
Faridpur (10)	-	23.49	24.22	-	20.54
Patuakhali (10)	-	26.18	-	-	25.43
Thakurgaon (10)	25.70	-	24.78	22.88	-
Gaibandha (10)	26.25	-	25.80	-	-
Kurigram (10)	22.11	-	25.36	-	-
Gazipur (10)	-	19.78	-	-	18.53
Nilfamari (10)	23.31	26.02	25.50	26.35	-
Joypurhat (10)	33.78	-	-	25.54	-
Bogra (10)	41.15	-	28.52	-	-
Pabna (8)	13.95	-	18.22	-	19.23
Kishoreganj (5)	-	24.36	-	21.37	-
Dinajpur (6)	26.54	-	27.41	28.63	25.22
Satkhira (10)	-	29.75	-	-	-
Mean	27.66	28.16	25.45	26.59	23.21

*Figures in the parenthesis indicates number of trials

Table 3.
Disease incidence of potato in seed plot technique trials at different locations of Bangladesh during 2008-09 to 2010-11

Location	% Disease & insect observed			
	LB	**Virus**	**Scab**	**Cutworm**
Munshiganj (10)*	0.00	0.50	1.30	1.95
Comilla (12)	0.00	0.40	15.28	2.94
Chandpur (3)	0.00	0.00	22.09	2.42
Chittagong (10)	0.00	0.47	15.50	5.11
Jessore (10)	0.00	5.00	5.00	0.00
Jamalpur (9)	3.00	1.00	1.93	1.84
Sheerpur (11)	0.00	0.83	7.71	1.48
Rangpur (13)	2.00	1.24	0.83	0.00
Rajshahi (10)	0.00	0.00	7.95	2.60
Faridpur (10)	0.00	0.00	6.13	3.38
Patuakhali (10)	0.00	0.00	8.50	0.00
Thakurgaon (10)	23.00	0.00	0.00	0.00
Gaibandha (10)	0.00	2.00	6.25	3.89
Kurigram (10)	1.50	1.20	15.50	1.00
Gazipur (10)	1.00	0.00	4.22	1.40
Nilfamari (10)	1.17	1.64	2.64	0.00
Joypurhat (10)	0.00	0.86	0.00	0.00
Bogra (10)	3.89	0.15	1.12	0.22
Pabna (8)	0.00	0.00	3.38	0.00
Kishoreganj (5)	7.50	1.50	21.00	3.20
Dinajpur (6)	2.00	2.00	1.00	1.00
Satkhira (10)	1.70	0.80	14.50	2.70
Mean	2.13	0.89	7.36	1.60

*Figures in the parenthesis indicates number of trials

Table 4.
Incidence of diseases in subsequent generations in seed potatoes produced from seed plot techniques

Disease	2nd generation	3rd generation
Virus (% plant)	0.8	3.1
Scab (% wt.)	2.3	4.9
Wilt (% plant)	nil	1.2
Black scurf (% plant)	nil	0.8