

YIELD POTENTIAL OF EXOTIC POTATO VARIETIES IN SUBSEQUENT GENERATIONS

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Abstract

Fifteen exotic potato varieties were evaluated for yield potential over three generations during 1989-90 to 1991-92. Both the fresh and dry yield were significantly higher in 2nd generation than 1st and 3rd generations. The average reduction of yield over 1st generation was found to be higher in Alkon, Granola, Obelix and Origo ranging (-10.3 to -38.8%) but very lower in Mondial (-0.7%) and Producent (-0.5%). On an average, the high increase in yield in subsequent generations over 1st generation was noticed in Bartina, Diamant, Liseta and Morene (17.3 to 64.5%). Similarly the degeneration of dry yield was observed in Granola, Obelix, Origo and Producent (1.1 to 40.5%) while the yield increased in Bartina, Diamant, Liseta, Escort, Morene and Thebes (17.5 to 38.8%). Considering the parameters studied, varieties viz. Ajiba, Bartina, Liseta, Mondial, Morene and Thebes showed acceptable performance in comparison to recommended variety Diamant.

Key words : Yield, Potentiality, Degeneration, Variety, Potato.

Introduction

The high quality seeds of different potato varieties are imported from abroad exclusively from Holland and these are evaluated for three successive generations under short day condition in Bangladesh for assessing its suitability as a commercial variety. Generally exotic varieties yield highest in their 1st generation provided good quality seeds are planted at proper time (TCRC, 1988). But planting of the imported seeds are usually delayed due both to late arrival of seeds and unfavourable weather resulting poor quality of

seed for 2nd generation (TCRC, 1989). As a result, the reduction or degeneration of yield in subsequent generation takes place with advancing generations. The rate of yield reduction over generation gives an idea about the degree of degeneration of a variety. The degree of degeneration in potato mainly depends on percent plant infested with diseases (viral, fungal and bacterial infestation). In strict sense, mainly virus diseases caused degeneration in the subsequent generations in vegetatively propagated crop like potato (TCRC, 1991). Viral degeneration of potato generally depends on the inherent resistance of

the host, growing condition and existing aphid situation (TCRC, 1990). Hence, an attempt was taken to identify the varieties that possess high yield potential and show slow degeneration in the subsequent years for commercial cultivation.

Materials and Methods

Fifteen potato varieties (Table 1) of Holland were introduced in Bangladesh in 1989. The trial was conducted at Regional Agricultural Research Station, Jessore in each rabi season for three successive generations during 1989-90 to 1991-92. The unit plot in each crop season was 3.0 m x 3.0 m. The trials were arranged in RCB design with three replications. The spacing was 60 cm x 30 cm accommodating 50 medium sized (28-45 mm) tubers per plot. The 1st, 2nd and 3rd generation seeds were planted on 13 Dec., 1989, 16 Nov., 1990 and 13 Nov., 1991, respectively and harvested on an around 110 days after planting. At the time of final land preparation Cowdung, Gypsum and Zinc Sulphate @10 tons, 200 kg and 4 kg per hectare, respectively were applied. Other fertilizers @125 N, 100 P₂O₅ and 125 K₂O kg/ha were used and applied according to TCRC recommendations (TCRC, 1990). Half of Urea and full dose of TSP and MP were applied at the time of planting beside the line in furrows and mixed properly with the soil. The rest amount of Urea were side dressed at 35 days after planting. For plant protection, the crop was sprayed with Dithane M-45 @ 0.2% and Dimecron 100 WSC @ 0.1% alternatively at an interval of 15 days. Other intercultural operations such as weeding, irrigation and earthing up etc. were done as per requirement. Data on different characters like fresh and dry matter yield, disease incidence were taken on whole plot basis.

Data were analyzed statistically, the difference among treatment means were

adjusted with Duncan's Multiple Range Test method (Steel and Torrie, 1960). Dry matter content in tubers was determined by using the methods adopted by Scheele *et al.* (1937) and subsequently dry matter yield was calculated for each variety.

Results and Discussion

Effect of generation on fresh yield potential and its reduction

The effect of generation on yield potential and yield reduction are shown in Table 1. The yield of different varieties in the 1st generation ranged from 14.9 t/ha (Producent) to 27.2 t/ha (Obelix) with an average yield of 20.6 tons indicated that in spite of late planting most of the varieties exhibited good yield in subtropical new environments under short day condition. Out of 15 varieties, Escort, Granola, Liseta, Morene, Producent and Romano yielded less than 20.0 t/ha. The reasons of having such lower yield were really unknown but it could be assumed that these varieties tuned their inability to show full potential with late planting. It is also stipulated that the significantly lower yield particularly in six varieties could partly be attributed due to inherent varietal diversity.

The average yield of 2nd generation crop was significantly higher (23.1 t/ha) than the 1st generation. This might be due to planting the 2nd generation crop in optimum time (Mid November) and the seeds that used as planting materials had acclimatized for a year. Additionally, it is expected that potato seeds that are stored for several months in cold storage likely to have good physiologic condition and show full potential. The increasing trend of yield in 2nd generation over 1st generation was observed in eleven varieties of which Liseta, Morene, Romano, Bartina and Escort showed maximum increase in yield (+85%, +41.3%, +29.4%, +25.6% and +24%, respectively). The reduction in yield ranging -3.8% to -20.7%

Table 1. Yield potential of different exotic potato varieties over generations.

Variety	Yield (ton/ha)				% increase or decrease over 1st generation			
	1st Gen. 1989-90	2nd. Gen. 1990-91	3rd Gen. 1991-92	Mean	for 2nd Gen.	for 3rd Gen.	Mean	% diseased plant*
Ajiba	21.2 b-d	22.14 bc	22.29 ab	21.88 b-d	+4.43	+5.14	+4.79	8.8
Alkon	23.0 a-c	24.36 ab	16.89 b-e	21.42 b-d	+5.91	-26.56	-10.33	11.7
Bartina	23.1 a-c	29.88 a	24.22 a	25.73 a	+29.35	+5.28	+17.32	4.3
Diamant	22.3 a-c	24.79 ab	22.63 ab	23.24 a-c	+11.16	+3.30	+7.23	3.6
Escort	18.7 b-e	23.48 b	20.40 a-c	20.80 b-d	+25.56	+9.09	+17.33	5.2
Granola	15.2 e	13.33 d	12.22 ef	13.58 g	-12.30	-19.60	-15.95	4.0
Liseta	16.2 de	29.96 a	23.36 a	23.17 a-c	+84.94	+44.14	+64.54	3.2
Mondial	23.6 ab	25.22 ab	21.66 ab	23.49 ab	+6.86	-8.22	-0.68	7.1
Morene	18.3 b-e	25.86 ab	22.14 ab	22.10 b-d	+41.31	+20.98	+31.15	3.2
Obelix	27.3 a	24.11 b	14.33 d-f	21.88 b-d	-11.36	-47.32	-29.34	4.2
Origo	22.7 a-c	18.01 cd	9.74 f	16.81 ef	-20.66	-57.09	-38.82	20.2
Producent	14.9 e	14.53 d	15.33 c-e	14.92 fg	-3.82	+2.88	-0.47	2.2
Romano	17.9 c-e	22.19 bc	20.37 a-c	20.11 cd	+23.96	+13.79	+18.87	2.7
Vital	22.8 a-c	25.50 ab	22.48 ab	23.59 ab	+11.84	-1.40	+5.22	9.0
Thebes	18.4 b-e	21.60 bc	18.92 a-d	19.60 de	+17.39	+2.83	+10.11	6.3
Mean	20.6 B	23.11 A	19.13 C	20.81	+14.10	-3.52	+5.40	

Treatments having same letters do not differ significantly by DMRT at 5% level.

Letters followed by small letters in a column denote varietal differences.

Letters followed by capital letters in a row denote generational differences.

* Average of three generations

was observed only in four (Granola, Obelix, Origo and Producent) varieties in 2nd generation over 1st generation indicated that these varieties were susceptible to degenerative diseases.

The mean yield of 3rd generation was lower than 1st and 2nd generation. In 3rd generation, nine varieties gave 2.8 to 44% higher yield while rest showed 1.4% to 57% reduction in yield than 1st generation. The varieties Obelix, Origo and Alkon showed highest percentage of yield degeneration in 3rd generation when compared to 2nd generation performance. All the varieties showed yield decline in 3rd generation as with the advancing of generation the crops were more exposed to

many diseases that ultimately reduced the yield in subsequent generations.

From the Table 1 it may be seen that out of 15 varieties, the yield of 11 varieties was higher in 2nd generation than 1st generation and out of these none could give higher yield in 3rd generation.

The rate of degeneration is calculated as percent yield reduction in successive generations over 1st generation. Considering all the three generations, the highest reduction in yield was observed in Origo (-38.8%) followed by Obelix (-29.3%). Granola (-16%) and Alkon (-10.3%) and lowest in Producent (-0.5%) while no reduction with trend of maintaining positive yield was noticed in Ajiba (+4.8%), Diamant

Table 2. Dry matter yield of different exotic potato varieties over generations.

Variety	Dry matter yield (ton/ha)				% increase or decrease over 1st generation		
	1st Gen. 1989-90	2nd Gen. 1990-91	3rd Gen. 1991-92	Mean	for 2nd Gen.	for 3rd Gen.	Mean
Ajiba	3.54 a-c	4.16 a-d	3.49 ab	3.73 ab	+17.12	-1.41	+7.85
Alkon	3.19 a-c	3.78 b-d	2.33 c-e	3.10 bc	+18.49	-26.96	-4.24
Bartina	3.30 a-d	4.41 ab	3.35 a-c	3.69 ab	+33.63	+1.51	+17.57
Diamant	3.68 a-c	4.58 ab	3.80 a	4.02 a	+24.46	+3.26	+13.86
Escort	2.81 c-e	4.05 b-d	3.17 a-c	3.34 bc	+44.13	+12.18	+28.47
Granola	2.21 b-e	2.08 e	1.70 de	2.00 d	+5.88	-23.07	-8.60
Liseta	2.53 b-e	5.08 a	3.39 ab	3.67 ab	+100.79	+33.99	+67.39
Mondial	3.40 a-d	4.13 b-d	3.03 a-c	3.52 bc	+21.47	-10.88	+5.30
Morene	2.90 b-e	4.49 a-c	3.56 ab	3.65 ab	+54.83	+22.75	+38.79
Obelix	4.02 ab	3.97 b-d	2.53 b-d	3.51 a-c	-1.24	-37.06	-19.15
Origo	4.09 a	3.36 cd	1.50 e	2.98 c	-17.84	-63.32	-40.53
Producent	3.09 a-e	3.21 d	2.90 a-c	3.07 bc	+3.88	-6.15	-1.14
Romano	3.04 b-e	3.74 b-d	3.05 a-c	3.28 bc	+23.03	+0.33	+11.68
Vital	3.76 a-c	4.40 ab	3.65 a	3.94 a	+17.02	-2.92	+7.05
Thebes	2.68 c-e	3.78 b-d	2.95 a-c	3.18 bc	+41.04	+10.07	+25.56
Mean	3.28 B	3.99 A	2.97 C	3.41	+21.65	-9.45	+6.10

Treatments having same letters do not differ significantly by DMRT at 5% level.

Letters followed by small letters in a column denote varietal differences.

Letters followed by capital letters in a row denote generational differences.

(+7.2%), Vital (+5.2%) and Thebes (+5.2%). Varieties Liseta, Morene, Escort and Romano also showed better adaptability under varied generations with high positive yield potential.

Effect of generation on dry matter yield and its reduction

Dry matter content in tuber gives a proximate idea about the starch content of a variety (Pushkarnath, 1976). It is an inherent character of any variety influenced by varied environment, management and generations.

Varieties, nowadays, are selected not only on the basis of fresh yield but also on the capability of producing dry matter. Because dry matter content and yield are negatively correlated i. e. variety that possess high yield potential have low dry matter content (Rasul *et al.*, 1990).

The dry matter yield and its degeneration as affected by different generation are shown in Table 2. Like fresh yield, dry matter yield was higher in 2nd generation than that of 1st and 3rd generation and the range varied from 2.00 to 4.02 t/ha. Diamant, the recommended variety, ranked top (4.02 t/ha) followed by Thebes

Table 3. Performance of promising potato varieties over three generations.

Variety	Foliage coverage (%)	Plant height (cm)	Tuber wt./hill (g)	Diseased plant (%)	Fresh yield (t/ha)	% degeneration	Dry matter yield (t/ha)
Ajiba	83.3	61.2	482.2	8.8	21.9	+4.8	3.73
Bartina	83.3	48.1	540.6	4.3	25.3	+17.3	3.69
Diamant	83.9	60.8	484.4	3.6	23.2	+7.2	4.02
Liseta	82.8	61.3	517.8	3.2	23.2	+64.5	3.67
Morene	89.4	62.7	498.9	3.2	22.1	+31.2	3.65
Mondial	87.8	79.4	562.2	7.1	23.5	-0.7	3.52
Thebes	83.9	62.6	492.8	9.0	24.1	+5.2	3.94

(3.94 t/ha), Ajiba (3.73 t/ha), Bartina (3.69 t/ha) and Liseta (3.67 t/ha). Out of 15 varieties more than 3 tons/ha dry matter yield was found in 12 varieties while rest three varieties namely Origo, Ramano and Granola yielded 2.98, 2.28 and 2.00 t/ha, respectively. The reduction or degeneration of dry matter yield in 2nd generation was noticed only in Origo (-18%) and Obilex (-1.2%) due to disease infestation (Table 2) that reduced fresh yield and ultimately affected dry yield. On an average dry matter yield in 2nd generation increased by +21.6% while it decreased by -9.5% in 3rd generation over 1st generation. Though the varieties Alkon, Ajiba, Granola, Mondial, Producent and Thebes showed their full potential regarding dry matter in 2nd generation but the yield was reduced from 2.9 to 26.96% in 3rd generation due to heavy disease incidence. Considering the degeneration in dry matter yield over generations, increased yield was recorded in Liseta, Morene, Escort, Diamant and Vital while poor performance was showed by Origo, Obilex, Granola and Alkon.

In fact it is not possible to select a variety that excels in all of the desired characters. Varieties Obilex, Origo and Granola gave good yield in 1st generation but the rate of yield reduction was very high in the subsequent

generations. In some varieties like Ajiba, Bartina, Diamant, Romano, Thebes and Vital did best in the 2nd and 3rd generation as compared to first generation. However, considering the studied parameters (Table 3) giving emphasis on fresh and dry yield and its degenerative trend and also disease incidence, the varieties Liseta, Bartina, Ajiba, Thebes, Mondial and Morene showed acceptable performance as compared to Diamant.

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