

Potato production from true seed stock in Uzbekistan

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Abstract

Scarcity of the qualitative seed material reflecting in the cultivation and productivity of potato is one of the main problems in Uzbekistan. Because of its high rank in the spending of seed material amounts (3,0-3,5 tons of potato seed tubers is planted per hectare) among the agricultural crops/ and here, the expenditure for only seed material consists of 50-60% out of all production expenditures per unit, there for, the enhancing of potato production efficiency by the measures focused on the lowering of production cost through the decreasing of seed material expenditures became one of the progressive challenges in agriculture. In the results of our experiments has been lightened that the least amount of plants (0,4-1,4%) were infected by the viruses of hidden character at the cultivation from the true seeds of potato. And the larger infection was defined on the species of Bup-8 (1,6%) and K7115 (1,4%) by the hidden manner viruses. One of the significant factors promoting the highest productivity of potato at cultivating from the true seed stock depends on the proper selection of the varieties. Obviously, the highest productivity (18,5 ton/ha) was observed in the hybrid population of "Deva" and the lowest index (4,8 ton/ha) devoted to the sample of K7115 (Table 3) Financial efficiency showed that acute declining of the expenses on the account of the seeding material has led to the higher rate (212,2%) of the profitability.

Keywords: true potato seed, greenhouse, seedlings, minitowers, potato seed tubers.

INTRODUCTION

The cultivation of potato by the generative method is being recommended in the recent years over the world along the vegetative multiplication. Generative method is used as the method of getting qualitative seeding tubers in the independent commonwealth states, the USA, International Potato Scientific Research Center (Peru, Lima) and China [18].

In the years of 1930-1960 and later many of the researchers had engaged with the generation of potato from its seeds [5,7,11,17, 19 and others].

Potato cultivation from the true seeds enables the economy of 3,0 - 3,5 tons of potato seed stock to be spent per hectare [5,7,9]. Except of this, the expenditures for storage and transportation of tubers are lowered.

At the mention of 60-65% expenditures out of the potato production have to made for seed material [7, 18] it is not difficult to understand that the seeding material is the one of the main problems in the expanding of potato production.

Beside this the multiplication by this method prevents the transferring of numeral pathogens to generation through the tubers at the vegetative cultivation method [5].

The creation of the healthy seed material based on the experiments have been carried out in our republic [1] on cultivation of virus free seed breeding from botanical seeds in the conditions of Uzbekistan is recommended and the creating of healthy initial material from the true seeds is used as the method in the seed is breeding of potato in the last years in our republic [7,6,18] likely to China, India and Fillippines. The efficiency of this method is also defined by the way that the taken plants will be healthy from fungi, bacteria and virus discuses.

Its reason, on the opinion researchers is connected that the disease causing agents will not transferred to progenies at the sexual reproduction [2]. But, the low rate infection of the plants by the viruses occurs at their vegetation period [2] or its takes place by the affect seed surface infection [1].

But were mentioned the splitting of studied potato varieties by them because of their heterozygosity to phenotype diversities in the crop, low productivity, delayed plant developing, longer vegetation and presence of same drawbacks likely to the lapsing of partial plants by different reasons.

Many varieties of the potato at the reproduction from botanical seeds due to the splitting are amity change and produce considerably distinguishing progenies on morphological characterizes, biological properties and productivity, there for cultivation of potato from true seeds is primarily purposeful its dependence with heresies hybrid populations producing phenotypic ally similar progenies

According to the results of executed experiments in the conditions of Uzbekistan, every bush in some of the plots yields 470-530 grams[7], depending on growing conditions are producing by 1-3 kg s of the crops [18], and their first and second reproduced tubers yield by 198,7-234,0 centers per hectare [9].

In our experiments, with the creation of initial material through the production of potato from true seeds on the virus free basis were put forward below presented goals.

- potentials and rates of virus discuses (TPS) transferring to the concussive, generations via the seeds ;
- definition of economical efficiency of potato production from true seeds;
- selection of suitable varieties to the marketable potato production from true seeds.

RESEARCH MATERIALS AND METHODS

We have brought 42 hybrid population and generative seeds of varieties from Research Institute of Plant Industry named after A.G.Lorh and seeds production firm “Sedek”, Moscow and separated out of 12 possessing at least or non-at all splitting hybrid populations and also used as the quality of experimental object.

Our experiments were carried out in the Samarkand strong fields of the Uzbek Vegetable, melon Crops and Potato Growing Scientific Research Institute in the Samarkand region (Uzbekistan).

Institute of its climate condition belonging to zones of mountain hills, the territory of strong point is ranged into acute continental climatic zones. Strong point is located at the 850 m above the sea level. Climatic conditions are characterized as hot summer and comparatively cold winter, precipitation distributed uneven(averages for 255 mm in the years of 2016-2018) and approximate air humidity.

Total cold tree days (not lower than 0⁰ C) on average equal to 215 days. An average temperature of the air is 13-14⁰ C, absolute maximum is +40⁰ C and absolute minimum is 26⁰ C.

Growing temperature of the soil (+5,3-+6,5⁰C) in march has enabled to begin planting works of potato. The wind speed at the strong point reaches at 4-6 meter per second, at sometimes this index gets up to 7-8 meters. The mechanical soil structure of our experimental field is moderate sandy.

The main part of the ground water is placed at the depth of 10-15 meters, and mainly snow or ice melting waters are used for watering. Beside thus also used water owing the water canal from Zarafshanrever.

The soil of our field experiments contents of humus-0,85%, nitrogen-0,16%, phosphorus-0,21% and potash-1,87%. (Agrochemical lab's data).

Germination of potato seed is determined in the lab condition by the putting of 100 seeds on the filter paper laid in the Petry cup and moistening (Table-1).

Cultivation of potato from generative seeds carried out on the base of methodological instruction on growing of potato from seeds . At this, in the first half of February (8-10.02) every sample was planted at the depth of 0,5-1 sm on the area of 2m² in the misery of greenhouse soils previously prepared at the equal ratio of 3 parts; soil, black sand and humus.

Planted area after planting of seeds was covered by a special oil-paper after.

The area after planting of seeds was covered by the special oil-paper on the concave shape to save humidity and inspected the sprinting of seedlings (Table 2).

At the period of seedlings forming they were adequately provided by moisture and at the height of 15-25cms or after 3-4 leaves setting (on the 40-45 days of vegetation) the seedlings have been really to planting in the field.

Cultivated seedlings were planted on prior watered rows of 70x20 sm scheme plots with size of 28 m² on 400 pairs in 3 replication and 2 seedlings were planted by hand in every seed-nest. Watering at the planting was at a little rate of 400-500 m³.

On the 25 day from the transplantation of seedlings to the field have been conducted the accounting of planted seedlings number and determined the survival of seedlings in percentages (%) (Table 3).

The subsequent cultivations have been continued similarly as the way of potato from tubers.

Definition of virus infections at the cultivation of potato from the true seeds has been fulfilled in two methods: clearly featured virus infections on the visual method and the bases of two serologic analysis at the periods of plant budding and blooming according to “ methodological instructions on the serologic diagnosis of virus and bacteria infecting of potato (Moscow,1972). At this the 100 plants from every plot as the sample were visually examined and evaluated on reflection of their disease signs.

At the definition of hidden virus discuses were taken the leaf samples from 3 heights of plants (from lower part on the 5 sm of height, middle and above). The juice of the leaf was extracted at the lab and the special whey was dropped into it. What kind of viruses action and at the extent of plants injury in the percentage (%) were determined according to the character of the deposition of the crusts.

Produced tuber crops were divided into groups

The small (less than 30 gr), middle (30-50 grs) and larger (more than 50 gr) and was evaluated at the 5 ball (all tubers similar, the shape typical to the variety, tuber buds do not get depth, smooth), not good by side-1 ball (the tubers are different on the size, tubers buds got deeply and hot smooth the surface of husk).

The productivity of the potato was evaluated on the crop of tubers per plant, number of the tubers and average weight (Table 5).

Economical efficiency in the potato production at the agriculture was determined via commonly accepted methodology of economical efficiency. Economical efficiency at the agricultural production is the result of the all processes and expresses by the cost of the expends per unit of arena.

The indexes of economical efficiency:

- total expends;
- production cost for 1 center of the product;
- marketing cost for 1 center of the product;
- the cost of the product per hectare;
- the net profit;
- indexes of profitability will be taken in the combinatic of productivity:

The manual of B.A. Dospekhov “Field experiment’s method” (1979) was used at the designing of the field experiments and statistical analysis of collected data along the variants.

Results and Discussions

The result of the experiments is presented in the (Table 6). It is shown in the table that the germination of the K7115 hybrid population was 48,5% and at the variety of Deva it was 84,6%. Likely to this characterize the survival: 74,2% and 95%. The vegetation period of the plants grown through seeds of potato is slightly longer than the potato grown from seeds. According to the experimental data of 118-134 days the variety Santa has 72 days at the cultivation from tubers.

It came into light that phenotypical uniformity of tubers is higher at the potato grown from the true seeds than potato grown from tubers. For example, the variety Santa taken as the standard one has the uniformity at 5 ball, Deva and Triumph have the highest indexes (4 ball) in the midst of all our remaining samples and the very lowest indexes were observed at the samples of K7115 and N2670, the results of visual evaluation of plants infection by the viruses discuses are revealed that plants’ infection by the viruses featured the symptoms of 0,2-0,5%. At the majority of the plants have observed the symptoms of the leaf twisting discuses.

At the serologic analysis were noted the least amount (0,4-1,6%) of seedlings infected by the hidden mannered viruses. Here, the more infected was the sample Vir-8 (1,6%) mainly by the viruses of Kh, S, m, all of other seedlings but Triumph and Nevskiy were infected by the virus of y, So, the least of infections devoted to the variety samples of Deva (0,4%) and Triumph (0,6%).

The disinfection of seedlings prior to the planting by the 1% solution of potash permanganate accordingly

of K.V. Popkovoy and others (1980) does not give positive results in our experiments. In the view of this we can say that the plants infection in the growing of potato from true seeds by the virus discuses takes place at the vegetation period at the seedlings.

Table 1.
Indexes of plants' growth, development and productivity

№	Hybrid popular Hons	Germination, %	Survival, %	Vegetation period, days	Biometric indexes		Phonologic uniformity of tubers, ball	Productive indexes		
					Plant height, sm	Number of leaves, piece plant		Productivity gr/ bush	Number of tubers piece/ bush	Average weight one tuber,
1	Pikasso	73	80	151	78,0	112	3	392,3	10,5	36,3
2	Ilone	78	91	128	66,4	125	3	376,4	10,5	32,2
3	K7115	48	74	118	38,5	104	1	122,4	4,9	26,9
4	Santa(st) Tuganak	-	-	72	68,5	196	5	573	9,8	58,5
5	Deva	84	95	127	78,2	159	4	450,2	10,8	41,7
6	Vir-8	58	83	110	45,2	121	2	310,5	9,4	31,3
7	Triumf	76	90	118	76,3	118	4	335,5	8,7	48,9
8	Assol	68	85	113	48,5	125	2	390	11	33,5
9	Vilona	69	74	112	56,2	136	2	250,8	8,8	26,5
10	Zolushka	60	78	132	65,4	142	3	365,2	9,2	39,7
11	N 2670	65	68	129	49,5	110	1	245,6	7,5	32,7
12	Nevskiy	71	79	125	69,2	128	3	364,5	9,3	39,2
* 5 ball-the best, 1ball-the bad										

Table 2.
infection of potato grown as the seedling from true seeds by the viruses (averaged data along the replications, 2016-2018)

№	Variety and the hybrid populations	Obviously infection, %	Infection by the discuses, in the %			Hidden infection in the %	Infection by the viruses, in the %				
			Simple mosaic	Lent twisting	Lined mosaic		X	S	M	U	Jointly
1	Pikasso	0,9	0,1	0,8	-	1,6	-	0,3	0,4	0,9	-
2	Ilone	0,3	-	0,3	-	0,5	-	-	-	0,5	-
3	K7115	0,5	-	0,5	-	1,4	0,4	0,2	-	0,8	-
4	Santa(st) Tuganak	0,2	-	0,2	-	0,4	0	-	-	0,4	-
5	Deva	0,4	-	0,4	-	0,6	0,2	0,4	-	-	-
6	Vir-8	0,3	0,1	0,2	-	0,8	-	0,3	-	0,5	-
7	Triumpf	0,5	-	0,5	-	1,1	0,7	-	-	0,4	-
8	Assol	0,6	-	0,6	-	0,9	-	0,5	-	0,4	-
9	Vilona	0,5	-	0,5	-	1,3	0,6	0,1	-	0,6	-
10	Zolushka	0,4	-	0,4	-	1,0	-	0,4	0,6	-	-
11	N 2670	0,6	0,1	0,5	-	1,2	0,3	0,5	-	0,4	-
12	Nevskiy	1,8	0,4	1,4	-	9,8	1,4	4,2	1,2	8,7	1,6

It was clear in our experiments that that the producing of product through the true seeds of potato depends on the proper selection of suitable hybrid populations as the planting cuddling. Accordingly, the highest productivity (18,5 ton/ha) was taken at the hybrid population of Deva and the lowest (4,8 ton/ha) from the hybrid-K7115 (Table 3).

Table 3.
Productivity of potato varieties and hybrids on the replications.

№	Variety and hybrid populations	Productivity on the replications, c/ha			Total yield, c/ha	Averaged yield, c/ha
		I	II	II		
1	Pikasso	123.4	124.5	124.1	372.0	124.0
2	Ilone	145.5	146.3	146.2	438.0	146.0
3	K7115	47.6	48.4	48.0	144.0	48.0
4	Santa(st) Tuganak	185.0	185.5	184.5	555.0	185.0
5	Deva	149.8	150.4	149.8	450.0	150.0
6	Vir-8	144.5	145.3	145.2	435.0	145.0
7	Triumf	134.6	135.5	134.9	405.0	135.0
8	Assol	124.4	125.4	125.2	375.0	125.0
9	Vilona	109.5	110.6	109.9	330.0	110.0
10	Zolushka	137.4	138.3	138.3	414.0	138.0
11	N 2670	139.0	141.2	139.8	420.0	140.0
12	Nevskiy	231.3	232.6	232.1	696.0	232.0
	Summa P	1672	1684	1678	5032.0= $\sum X$	X=139.83

With the stand point of economic efficiency at the potato production we can see the incensing of rate of profitability up to 212,2% on the account of sharply decreasing the expenditures for the seed materials at this kind of our experiments was clear the inefficiency of the K-7115 hybrid population (Table 3).

It is seen from the data of the table that the total expenditures on the account of seed materials for the cultivation of the variety Santa from tubers excluded almost twice in comparison with other variants. That's why, in spite of the high productivity (23,2 ton/ha) of the variety Santa its profitably has consisted the rate of 126,7%.

Table 4.
Economical efficiency of potato production from the true seeds (averaged for 3 years).

№	Total expenses thousand sum/ha	Productivity c/ha	Cost of products, thousand sum/ha	Market sale cost, thousand sum/ center	Net profit, thousand sum/ha	Profitability rate, %		
1	Pikasso	5590	124	45,1	95	11,780	6,190	110,7
2	Ilone	5620	146	38,5	95	13,870	8,250	146,8
3	K7115	5560	48	115,8	95	4,560	-1,000	-
4	Santa(st) Tuganak	5630	185	30,4	95	17,575	11,945	212,2
5	Deva	5640	150	37,6	95	14,250	8,610	152,7
6	Vir-8	5720	145	39,4	95	13,775	8,055	140,8

7	Triumf	5620	135	41,6	95	12,825	7,205	128,2
8	Assol	5550	125	44,4	95	11,875	6,325	114,0
9	Vilona	5610	110	51,0	95	10,450	4,840	86,3
10	Zolushka	5620	138	40,7	95	13,110	7,490	133,3
11	N 2670	5610	140	40,1	95	13,300	7,690	137,1
12	Nevskiy	9720	232	41,9	95	22,040	12,320	126,7
1\$= 2442.13 So'm (3.02.2015. The Central Bank of Uzbekistan)								

Number of replications: $l=3$

Number of the varieties: $n=12$

Number of general inspections: $N=ln=12 \times 3=36$

Table 5.
difference of yield from the average productivity on the replications

№		$Xl=X-Mo'rt$			Summary of differences $\sum V$
		I	II	III	
1	Pikasso	-16.4	-15.3	-15.7	-47.5
2	Ilone	5.7	6.5	6.4	18.5
3	K7115	-92.2	-91.4	-91.8	-275.5
4	Santa(st) Tuganak	45.2	45.7	44.7	135.7
5	Deva	10.0	10.6	10.0	30.5
6	Vir-8	4.7	5.5	5.4	15.5
7	Triumf	-5.2	-4.3	-4.9	-14.5
8	Assol	-15.4	-14.4	14.6	-44.5
9	Vilona	-30.3	-29.2	29.9	-89.5
10	Zolushka	-2.4	-1.5	-1.5	-5.5
11	N 2670	-0.8	1.4	0	0.5
12	Nevskiy	91.5	92.8	92.3	276.5
	$\sum P$	-6.0	6.0	0.0	0.0

$$\sum P = \sum V = \sum Xl = 0.0$$

$$\text{Correction factor: } C = (\sum Xl)^2 : N = (0.0)^2 : 36 = 0.0$$

$$\text{Totally: } Cy = \sum Xl^2 - C = (16.4^2 + 15.3^2 + \dots + 92.3^2) - 0.0 = 61578.9$$

$$\text{On the replications: } Cp = \sum P^2 : l - C = (6.0^2 + 6.0^2 + 0.0^2) : 12 - 0.0 = 6.0$$

$$\text{On the varieties: } Cv = \sum V : n - C = (47.5^2 + 18.5^2 + \dots + 276.5^2) : 3 - 0.0 = 61571.0$$

Table 6.
Results of the dispersion analyze

Dispersion	Summary of square	Vacant rate of number	Average squar
General on replication on the variety resianc	61578.9	35	0.06
	6.0	2	
	15392.7	11	
	1.9	33	

$$\frac{2s^2}{n}$$

Arrow of the experiment: $Sd = \frac{2s^2}{n}$

A great attention has been paid to the accuracy to experiment and its typness at the all stages of the selection process in order to take the authentic data in the tests and evaluations of the varieties selection materials. Experiment accuracy is defined by the arrows the less will be the experiment's accuracy.

The experiment accuracy at our experiments was excellent:

Experiment error: LED_{05} (HCP_{05}) = to Sd = equal to 0,41 c/ha (the lower and upper print is to write the next)

LED_{05} = 1,1%, it points out the experiment's accuracy.

Conclusions:

1. To produce potato from the true seeds as the new and efficient method can be used in the conditions on Samarkand.
2. The produced tubers of the first reproduction can be used as the seed material due to their least amount of infection by the viruses.
3. the method's efficiency depends on the proper selection of the varieties and hybrid populations.
4. we have found the suitability of the varieties Deva and Triumph to reproduction from the true seeds. The first and when needs the second reproduction of tubers can be used as the seed material. The second and next reproductions can be used in the purposes of the food (commodities).

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