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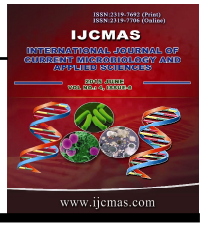

Original Research Article

Potato Production from True Potato Seed in Uzbekistan

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A B S T R A C T

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 has 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 state at the cultivation from the true seeds of potato. And the larger infection was determined on the species Vir-8 (1,6 %) and K7115 (1,4%) by the hidden viruses. One of the significant factors promoting the highest productivity of potato at the cultivating from the true seed stock depends on the proper selection of the varieties. 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 lead to the higher rate of the profitability (212,2%).

K e y w o r d s

The true potato seed, Greenhouse, Seedlings, Minitubers, Potato seed tubers

Introduction

The cultivation of potato by the generative method is being recommended in the recent years throughout the world in combination with 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 (Ostanakulov, 1997).

In the years of 1930-1960 and later many of the researchers had engaged with the generation of potato from its seeds (Budin, 1986; Garava, 1988; Ostanakulov, 1991, Ergashev, 1998; Zhuev, 2005).

Potato cultivation from the true seeds enables the economy of 3,0 - 3,5 tons of potato seed stock to be outlaid per hectare (Budin, 1986; Ergashev,1998; Ergashev, 2000). Except of this, the expenditures for

storage and transportation of tubers are also lowered.

At the mention of 60-65% expenditures out of the potato production which have to be made for seed material (Ostanakulov,1997; Ergashev,1998) 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 numerals pathogens to generation through the tubers at the vegetative cultivation method (Budin, Sabolyova, 1987).

The creation of the healthy seed material based on the experiments which have been carried out in our republic (Abdukarimov, Ostanakulov, Ergashev, 2002) for cultivation of virus free seed breeding from botanical seeds in the conditions of Uzbekistan is recommended. And, in the last years the creating of healthy initial material from the true seeds is used as the method of potato in our republic (Ergashev, 2006; Budin, 1987; Ostanakulov, 1997) likely to China, India and Philippines.

The efficiency of this method is also defined by the way that the taken plants will be healthy from fungi, bacteria and virus diseases.

Its reason, on the view of the researchers is connected with the disease causing agents, which will not transferred to progenies at the sexual reproduction (Budin, 1990; Sobeleva, 1987). But, the low rate infection of the plants by the viruses takes place at their vegetation period (Abdukarimov, Ostanakulov, 2000) or by the affect of seed surface infection (Abdukarimov, 1991; Ergashev, 1995; Ostanakulov,1991).

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

Many varieties of the potato at the reproduction from botanical seeds due to the splitting are considerably changed and produce greatly distinguishing progenies on morphological characterizes, biological properties and productivity, there for cultivation of potato from true seeds is primarily purposeful its dependence with heterosis hybrid populations producing phenol-typically 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 (Ergashev, Elmurodov, 1995; Budin, 1990), depending on growing conditions are producing by 1-3 kg s of the crops (Ostanakulov, 1997), and their first and second reproduced tubers yield by 198,7-234,0 centers per hectare (Ergashev, 1998).

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

-potentials and rates of virus diseases (TPS) transferring to the next generations via the seeds
-definition of economical efficiency of potato production from the true seeds
- cultivars' selection from the true seeds to the marketable potato production

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).

In spite of institute's climate condition which is belonging to the zones of mountain hills, the territory of strong point is included into the range of the 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 2012-2014) and relative air humidity.

Total cold free days (not lower than 0 ^{0}C) on average are equal to 215 days. An average temperature of the air is 13-14 ^{0}C, absolute maximum is +40 ^{0}C and absolute minimum is -26 ^{0}C.

Growing temperature of the soil (+5,3-+6,5 ^{0}C) 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 this water also used owing the water canal from the river of Zarafshan.

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 Petri dish and moistening (Table-1).

Cultivation of potato from generated seeds carried out on the base of methodological instruction for growing of potato from seeds ((Leningrad, 1987). At this, in the first half of February (8-10.02) every sample was planted in the depth of 0,5-1 cm on the area of 2m^2 in the nursery of greenhouse soils previously prepared at the equal ratio of 3 parts: soil, black sand and humus.

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

To save the humidity of the area after planting of seeds was covered by the special oil-paper on the concave shape and inspected the sprouting of seedlings (Table 1).

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 seedlings (on the 40-45 days of vegetation) and they were ready to plant in the fields.

Cultivated seedlings were planted on prior watered rows of 70x20 sm scheme plots with size of 28 m^2 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 m^3.

The accounting of planted seedlings' number has been conducted on the 25 day from the transplantation of seedlings to the fields 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 analyses at the periods of plant budding and blooming according to "Methodology instructions on the serologic diagnosis of virus and bacterial infecting of potato" (Moscow, 1972). At this the 100 plants from every plot as the sample were visually examined and evaluated on the reflection of their disease symptoms.

At the definition of hidden virus diseases, the leaf samples were taken from the 3 heights of plants (from lower part on the 5 cm 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 (Table 4).

Produced tuber crops were divided into groups: the small (less than 30 gr.), middle (30-50 gr.) and larger (more than 50 gr.) and was evaluated at the 5 balls (all tubers similar, the shape typical to the variety, tuber buds do not get depth, smooth), not good by cide-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 1).

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 expends per unit of area.

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 combination of productivity:

The manual by B.A. Dospekhov "The method of field experiments" (1979) has been used at the designing of the field experiments and at the statistical processing of collected data along the variants.

Results and Discussions

The result of the experiments is presented in the (Table 1). It is shown in the table that the germination of the K7115 hybrid population was 48,5 % and on the variety of Deva it was 84,6%. Likely to this their survival characterizing respectively: 74,2 % and 95%. The vegetation period of the plants grown by the seeds of potato is slightly longer than the potato grown from tubers. According to the experimental data of 118-134 days the variety Santa has 72 days to the cultivation from tubers.

Due to our experiments it brought to light that phenotypic 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) among of all our remaining samples and the very lowest indexes were surveyed at the samples of K7115 and N2670, the results of visual evaluation of plants' infection by the viruses diseases have revealed that plants' infection by the viruses featured the symptoms of 0,2-0,5%. At the majority of the plants have been observed the symptoms of the leaf twisting (Table7).

Table.1 Growth, development and productivity indexes of plants

№	Hybrid populations and varieties	Germination,%	Survival,%	Vegetation period, days	Biometric indexes		Phonologic uniformity of tubers, ball	Productive indexes		
					Plant height, cm	Number of leaves, piece on plant		Productivity gr/ bush	Number of tubers piece/ bush	Average weight one tuber
1	Vir-8	58	83	130	55,2	121	2	312,5	9,4	33,2
2	Ilone	78	91	118	66,4	125	3	386,4	10,5	36,8
3	K7115	48	74	134	43,5	104	1	145	4,9	29,6
4	Deva	84	95	127	78,2	159	4	450,2	10,8	41,7
5	Triumf	76	90	128	76,3	118	4	355,5	8,7	40,9
6	Assol	68	85	123	48,5	125	2	390	11	35,5
7	Vilona	69	74	119	56,2	136	2	250,8	8,8	28,5
8	Zolushka	60	78	132	65,4	142	3	365,2	9,2	39,7
9	N 2670	65	68	129	49,5	110	1	245,6	7,5	32,7
10	Nevskiy	71	79	125	69,2	128	3	364,5	9,3	39,2
11	Pikasso	73	80	131	74,1	112	3	396,3	10,5	37,7
12	Santa(st) Tuganak	-	-	72	68,5	196	5	573	9,8	58,5
* 5 ball-the best, 1ball-the worst										

Table.2 Infection of potato grown as the seedling from the true seeds by the viruses (averaged data along the replications, 2012-2014)

№	Variety and the hybrid populations	Obviously infection,%	Infection by the diseases, in the %			Hidden infection, in the %	Infection by the viruses, in the %				
			Simple mosaic	Leaf twisting	Lined mosaic		X	S	M	Y	Jointly
1	Vir-8	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	Deva	0,2	-	0,2	-	0,4	0	-	-	0,4	-
5	Triumf	0,4	-	0,4	-	0,6	0,2	0,4	-	-	-
6	Assol	0,3	0,1	0,2	-	0,8	-	0,3	-	0,5	-

7	Vilona	0,5	-	0,5	-	1,1	0,7	-	-	0,4	-
8	Zolushka	0,6	-	0,6	-	0,9	-	0,5	-	0,4	-
9	N 2670	0,5	-	0,5	-	1,3	0,6	0,1	-	0,6	-
10	Nevskiy	0,4	-	0,4	-	1,0	-	0,4	0,6	-	-
11	Pikasso	0,6	0,1	0,5	-	1,2	0,3	0,5	-	0,4	-
12	Santa(st) tuber	1,8	0,4	1,4	-	9,8	1,4	4,2	1,2	8,7	1,6

Table.3 Potato varieties' and hybrids' productivity on replications

№	Variety and hybrid populations	Productivity on the replications, c/ha			Total yield, c/ha	Averaged yield, c/ha
		I	II	II		
1	Vir-8	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	Deva	185.0	185.5	184.5	555.0	185.0
5	Triumf	149.8	150.4	149.8	450.0	150.0
6	Assol	144.5	145.3	145.2	435.0	145.0
7	Vilona	134.6	135.5	134.9	405.0	135.0
8	Zolushka	124.4	125.4	125.2	375.0	125.0
9	N 2670	109.5	110.6	109.9	330.0	110.0
10	Nevskiy	137.4	138.3	138.3	414.0	138.0
11	Pikasso	139.0	141.2	139.8	420.0	140.0
12	Santa(st) tuber	231.3	232.6	232.1	696.0	232.0
	Totally P	1672	1684	1678	5032.0=∑X	X=139.83

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

№	Total expenses, thousand sum/ha	Productivity c/ha	Productivity, 100kg/ha	Production cost of products, thousand sum/ 100kg	Unit of sold Marketing sale cost, thousand sum/ 100kg	Unit of sold products, thousand sum/ha	Net profit, thousand sum/ha	Profitability rate, %
1	Vir-8	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	Deva	5630	185	30,4	95	17,575	11,945	212,2
5	Triumf	5640	150	37,6	95	14,250	8,610	152,7

6	Assol	5720	145	39,4	95	13,775	8,055	140,8
7	Vilona	5620	135	41,6	95	12,825	7,205	128,2
8	Zolushka	5550	125	44,4	95	11,875	6,325	114,0
9	N 2670	5610	110	51,0	95	10,450	4,840	86,3
10	Nevskiy	5620	138	40,7	95	13,110	7,490	133,3
11	Pikasso	5610	140	40,1	95	13,300	7,690	137,1
12	Santa(st) tuber	9720	232	41,9	95	22,040	12,320	126,7
1$= 2442.13 Som (3.02.2015. The Central Bank of Uzbekistan)								

Number of replications: 1=3
Number of the varieties: n=12
Number of general inspections: N=ln=12x3=36

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

№		X1=X-M average			Summary of differences ∑V
		I	II	III	
1	Vir-8	-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	Deva	45.2	45.7	44.7	135.7
5	Triumf	10.0	10.6	10.0	30.5
6	Assol	4.7	5.5	5.4	15.5
7	Vilona	-5.2	-4.3	-4.9	-14.5
8	Zolushka	-15.4	-14.4	14.6	-44.5
9	N 2670	-30.3	-29.2	29.9	-89.5
10	Nevskiy	-2.4	-1.5	-1.5	-5.5
11	Pikasso	-0.8	1.4	0	0.5
12	Santa(st) tuber	91.5	92.8	92.3	276.5
	∑P	-6.0	6.0	0.0	0.0

∑P=∑V=∑X1=0.0
Correction factor: $C=(\sum X1)^2:N=(0.0)^2:36=0.0$
Totally: $Cy=\sum X1^2-C=(16.4^2+15.3^2\ldots+92.3^2)-0.0=61578,9$
On the replications: $Cp=\sum P^2:1-C=(6,0^2+6,0^2+0,0^2):12-0,0=6,0$
On the varieties: $Cv=\sum V:n-C=(47.5^2+18.5^2+\ldots.+276.5^2):3-0.0=61571.0$

Table.6 Results of the dispersion analyze

Dispersions	Summary of square	Vacant rate of number	Average square
General	61578.9	35	
On replication	6.0	2	
On the variety	15392.7	11	
Residue	1.9	33	0.06

Error of the experiment: $Sd=\frac{2s2}{n}$

Abbreviations: TPS – the true potato seeds.

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 X, S, M, all of other seedlings but Triumph and Nevskiy were infected by the virus of Y. So, in a less degree of infected samples were Deva (0,4%) and Triumph (0,6%).

The disinfection of seedlings prior to the planting with the 1% solution of potash permanganate accordingly of K.V. Popkovoy and others (1980) does not give any positive results in our experiments. In the view of this we can say that the plants' infection by the virus diseases in the growing of potato from true seeds takes place at the period of seedlings' vegetation.

It was clear in our experiments that the producing of product through the true seeds of potato depends on the proper selection of suitable hybrid populations as the planting seedlings. 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).

With the stand point of economical efficiency at the potato production we can see the increasing rate of profitability up to 212,2% on the account of sharply decreasing the expenditures for the seed materials. An inefficiency of the K-7115 hybrid population was clear at the method of our experiments (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 have exceeded 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%.

A great attention has been paid to the accuracy of the experiment and its uniformity at the all its 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 determined by the arrows got out from the impossibilities of the designing of completely similar terms in all parts of the field. The more of such errors the less will be the experiment's accuracy.

Experiment's accuracy at our experiments was at the excellent level:
Experiment error: LED_{05} (HCP_{05})= to Sd= equal to 0,41 c/ha
LED_{05}=1,1%, it points out the experiment's accuracy.

Conclusions

1. To produce potato from the true seeds as a new and an efficient method may be used in the conditions of Samarkand.
2. The produced tubers of the first reproduction may be used as the seed material owing their least amount of infection by the viruses.
3. This 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 may be used as the seed material. The second and next reproductions may be used in the purposes of the food commodities.

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