Application of genetic method in protection of potatoes from pests and diseases

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INTRODUCTION

According to the opinion of Large number of researchers, selection and growing of resistant varieties is one of the most efficient ways of getting of stably high potato crops which are justified on ecologic and sanitary and hygiene grounds, as well as manufacture of products free from chemical. Weed and pest killers in the process of the prurience of e research it was expected to distinguish such varieties, which confirms its timeliness.

Connection of research with scientific agenda, plans, topics.

The research was carried out in connection with work programs of chair of biotechnology and phytopharmacology (state registration No. 0110U002918).

The purpose of research was to select potato varieties, suggested for growing in Ukraine, which are resistant to the most spread diseases and pests, and which are characterized with other useful economic features.

Research methods. The applied methods are generally accepted in the process of performance of the experiments with potato.

Research novelty. For the first time the varieties were selected in the North-Eastern part of forest steppe of Ukraine, which are resistant to the most spread pests and are characterized with a complex of other useful features, that is Vymir, Latona, Dovira, Roko.

Research practical importance. Selected varieties of potato, resistant to the most spread diseases and pests with a complex of other useful features (Vymir, Latona, Dovira Roko) are recommended for practical use.

Paper approbation. The paper was presented at meeting of chair of biotechnology an phytopharmacology of Sumy National Agrarian University, conference of students Sumy National Agrarian University (2011).

Publications. The students of Sumy National Agrarian University, December 8-12, 2011 (Attachment A).

Paper composition and volume. The diploma paper consists of eight chapters, summary, recommendations for production, bibliography. The paper consists of 91computer typed pages, contains 14tables. 6drawings. 5attachments. Bibliography consists of 46items, including 28items in Latin.

The research was carried out on the experimental ground of chair of biotechnology and phytopharmacology. According to the data received with the aid of chair of arable farming, soil science and agricultural chemistry, the soil of the ground is typical middle- loam heavy dust - like black soil. Humus content - 3.9 %.

Weather conditions within the period of performance of experiment were distinct in long-term average annual data. During the majority of ten-day periods of 2011 the air temperature was higher, than before. The higher temperature was also fixed in 2010, when the difference with average long-term temperature in some periods amounted to 11° C. Because of high temperature, the lack of humidity was fixed, especially in 2010.

Taking into account the presence in Ukraine of areas with invasion of Heterodera rostochiensis Wollenweber, it is important to select the varieties with genetic resistance to eelworms.

The data of table No. I confirm that some selective establishments of the country pay attention to selection of such varieties.

Table No.1

Classification of varieties, registered in the Registry, according to maturity group and resistance to potato root eelworm (Heterodera rostochiensis) depending on the originator establishment (country).

Selective establishments of Ukraine, other countries	Varieties, pes.	Including %				
		Resistant to eelworm	early	Middle-early	Mid-season	Middle-late
Institute for Potato Research of Ukrainian Academy of Agricultural Sciences	38	32	26	26	34	14
Polissia experiment station	25	32	44	40	4	12
Research and Production Association "Chernihivelit-kartoplia" CISC	6	50	33	0	67	0
Institute for Agriculture and Breeding for Western region	4	0	0	25	5	0
Sumy National Agrarian University	8	88	50	38	12	0
Lviv National Agrarian University	3	100	33	0	67	0
Germany	29	76	48	38	7	7
Netherlands	22	73	37	18	27	18

First of all these are Sumy and Lviv National Agrarian Universities, which have higher rate, than the varieties from Germany and Netherlands.

In order to get high crop, it is necessary that varieties have resistance to viral diseases. According to our data (table No. 2) it is clear, that only a small amount (3,2 – 12,6 %) did not have external signs of disease according to years and lists.

Besides, the varieties with two or more signs of viral diseases dominated. We selected the varieties with the highest evidence of such resistance, that is Vymir. Zaviia Dniprianka, Nezabudka, Vrnisazh, Kuroda and some other, which are considered to be very essential for growing in areas with great viral diseases shedding.

Comparing with fungus diseases under conditions of the North-Eastern forest-steppe of Ukraine, the viral diseases had greater shedding.

The data of table No.2 display difference in showing of resistance to viral of diseases depending on environmental conditions.

A number of researches have proved, that adherence to procedure of potato growing, especially application of sufficient amount of balanced mineral and organic feeding, providing of plants with humidity suppress the signs of viral diseases, that is many viruses are in latent.

According to the results of performed researches, the beginning of potato vegetation (May month) in 2010 was characterized with humidity deficit (the rate of rain was 19,5 mm lower, than average for the long period) and high air temperature (average within a month 3,4°c higher than average long-term), which in our opinion was favorable for manifestations of viral diseases. That is why only 6,4% of varieties had no signs of involvement.

We consider that because of lack of genetic control on virus resistance many varieties had signs of two or more diseases.

Table No. 2

Manifestation of viral diseases among varieties .

year	list	Estimated pcs.	Including %			
			Symptom - free	Manifestation of		
				one	two	three
				Disease(s)		
2010	first	157	6,4	41,3	45,9	6,4
	Second	157	3,2	42,8	50,2	3,8
2011	first	127	5,5	33,5	51,0	10,0
	Second	127	12,6	20,7	50,7	16,0

The last had frequency 6,4 % which was equal to the number of varieties without signs of disease: A little less than a half of varieties had signs of two diseases in different combinations .

The data received (table No. 3) attest to the biggest extension of rugose mosaic and mosaic torsion of leaves; Apart from the second list in 2010 the separate manifestation of the firs disease was higher than of the second.

Environmental conditions of 2011 had various influence on mani festation of rugose separately, as well as in combination with other viral diseases. In the first case, the number of plants with signs of disease according to two lists (18,9 and 18,0%) was almost equal. However, while its combination with other diseases, a part of varieties under the first list amounted to a half of varieties under research.

The opposite concerned group manifestation of signs of these diseases. Only according to the first list in 2011 the frequency of varieties with rugose mosaic and other diseases was higher.

Compared with rugose mosaic, mosaic torsion of leaves in general was characterized with smaller extension. On its own it had higher extension in 2010 (19,1 % in the first list and 17,2 % in the second) . The opposite was fixed in 2011, when the part of varieties with the signs of disease in the first list was smaller in comparison with the second. Apart from the second list, carried out in 2011, the part of varieties, combining the signs of mosaic torsion of leaves with other diseases , was almost equal (within 34,1-38,0 %) However , in the second list in 2011 their number was significantly below (2,3 times smaller in comparison with minimal data rate in 2010 and the first list of 2011).

Table NO. 3

Frequency of manifestation of some viral diseases.

year	List	Number of varieties with signs of diseases, pcs.	Including which the signs of diseases, %			
			Rugose mosaic		Mosaic torsion of leaves	
			separately	With other	separately	With other
2010	first	147	26,1	33,8	19,1	34,4
	Second	152	13,2	29,1	17,2	38,0
2011	first	120	18,9	48,1	14,2	34,1
	Second	111	18,0	14,2	15,1	15,1

According to some scientists' opinion (44), the variety is a "compromise" between crop. quality of bulbs and a certain level of resistance to the most spread and harmful diseases. Though on the other hand, differences in genetic control on the stated and other signs allow combining them in one variety, however, it is hard to fulfill it, in witness where of the history of potato selection can be mentioned.

Selected varieties with resistance to viral diseases were characterized with manifestation of other economic-essential signs (table No.4). That is, productivity (varieties Vymir Kuroda. Vernisazh). marketability of crop (Dniprianka, Vymir), average mass of bulb (Vymir, Kosen95), a number of bulbs under the bush (Nezabudka, Malynskyi bilyi). Depending on necessity of presence of the complex of signs, some of them were recommended for growing in the area.

Economic efficiency of growing of resistant varieties was distinguished according to the common methodology [41], by means of data comparison on

the ground of standard varieties (basic variant) and selected in the process of research (experimental variant).

Taking into account that higher crops, as well as other economic-essential signs had the varieties of different groups of ripeness, standard varieties in state variety trial were applied as the basic variant.

Data of table No.5 indicate the high efficiency of growing of selected varieties, which exceeds greatly efficiency of standard sorts Serpanok, Zabava and Yavir.

Table NO. 4

Manifestation of the main economic-essential sings among the varieties, resistant to viral diseases.

Variety	Resistant to viral diseases		Productivity, g/bush	Crop marketability,%	Average mass of bulb (g)	Average number of bulbs, pcs.
	2010 r.	2011 r.				
Vymir	3k8	6/n	709	88	83	9
Zaviya	6/n	6/n	448	84	52	9
Kuroda	Mn18	6/n	539	84	70	8
Dniprianka	3k8	3k8	412	94	52	7
Kosen95	Noj18	6/n	497	85	73	7
Nezabudka	Mn18	Mn18	434	62	42	11
Malynskyi bilyi	Mn18	3k8	425	76	43	10
Zernisazh	Ck8	6/n	539	86	61	9

Table NO. 5

Economic efficiency of growing of the varieties, resisties to hazardous organisms .

Variety	Crop, ton/ha	Standard excess, ton/ha	Profit, UAH/ha	Standard excess, ton/ha	Efficiency, %
Standard variety serpanok, basic	20,1	-	16810	-	146
Variety under research vymir	28,9	8,8	28821	12011	243
Variety under research latona	30,4	10,3	27635	10825	226
Standard variety zabava, basic	19,7	-	11174	-	96
Variety under research dovira	40,4	20,7	33972	22798	268
Standard variety yavir, basic	29,3	-	24202	-	203
Variety	38,2	8,9	37835	13633	301

SUMMARY

1. It was determined that the majority of varieties resistant to eelworm (Globodera rostochiensis), suitable for growing in Ukraine, were selected in Lviv (100 %) and Sumy (88 %) National Agrarian Universities . Manifestation of sign is controlled by gene Ro-l .
2. In the Register of varieties, suitable for growing in Ukraine, there varieties resistant to aggressive pathotypes of potato cancer. The best of

them according to complex of economic-essential signs are Vodograi, Svaliavskyi. Gorlytsia.

3. A small number of varieties (within 3,2-12,6 % of all accountable) was detected, which have no signs of viral diseases. The majority had the signs of involvement of two viral diseases (45,9-51.0 %) .
4. According to two lists the most wide-spread (separately or together with other diseases) had rugose mosaic , in 2010-13,2-26,1 % and 29,1-33,8 % accordingly , and in 2011-18,0-18,9% and 14,2-48,1% . Mosaic torsion of leaves had lower manifestation.
5. The possibility of combination of resistance to Globodera rostochiensis with manifestation of other economic-essential signs was found, which is equal to resistance to viral diseases.

RECOMMENDATIONS FOR PRODUCTION

In the areas, where aggressive pathotypes of potato cancer are spread, it is recommended to grow resistant varieties, such as Vodograi, Svaliavskyi, Gorlytsia, which combine the stated sign with other economic-essential.

On the fields with invasion of Globodera rostochiensis it is recommended to grow resistant varieties with high manifestation of other economic signs: early- Dzhaerla, Latona, middle-early - Dovira and mid-season -Slavianka, Roko.

Varieties resistant to viral diseases with complex of other essential signs, that is Vymir, Kosen 95. Kuroda, are recommended to grow in areas with high extension of viral diseases.

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