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Full Length Research Paper

The contribution of the genetic factors of potato lines to the northern area of Western Romania

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The creation of some potato genotypes with a high genetic homeostasis could confer a greater ecological plasticity with an increased resistance to the attack of the pathogen agents, such that notable performances concerning the main quality features represent the objectives reached in the potato breeding laboratory from ARDS of Suceava. Taking into consideration the area offered by the institution, the climatic conditions are favorable to many diseases, knowing the contribution of the genotype to the attenuation of its limitative effects represented by a great preoccupation. Besides the mentioned aspects, some quality features have been taken into consideration, such as: the form of the tubers, the depth of the eyes, the skin suberization level, the color of the pulp which confers a commercial quality and of course the economic increase of the production. This work is part of a more vast thematic research, initiated with the purpose of creating new potato advanced cultivars through an increased production capacity. With good resistance to the biotic and abiotic stress factors, advanced cultivars with superior culinary qualities are suitable for industrialization. The quantity and quality features depend to a great extent on the genetic income of the partners, in such a way that these characters have been transmitted in pedigree and the recombination specific capacity.

Key words: Advanced cultivars, potato lines, vegetation period.

INTRODUCTION

Potato has probably more related wild species than any other crops, since the genus Solanum comprises around 2000 species (Hawkes, 1990). Potato breeders usualy use wild *Solanum* species as sources of disease resistance genes (Hijmans and Spooner, 2001). The cultivated potato in Europe, having its origin in the South and Central America, cannot have the possibility to improve the genetic material with the other species of *Solanum* genus, and as such, it is evaluated as having low number of genotypes (Hawkes, 1990). The variety is a main resource for increasing the yield without supplementary cost and energy (Bodea, 1994). Improvement of the cultivar sets with this new genotype represents one of the most efficient ways for increasing the yield productivity, quality and stability, since it less undergoes stress as a result of the less favorable biotic factors (Grădinaru et al., 1986).

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Backcrosses with varieties which have different levels of resistance to late blight and valuable cultural characters, such as shape, size and tuber quality, were made to improve the cultural characters of the plants (Blundy et al., 1991). The correlation between the resistant genotype frequency in each hybrid generation and the late blight resistance of the parents used was taken into consideration (Ceapoiu and Floare, 1983). Revealing of the genetic variability of local populations of *Pytophthora infestans* is a crucial step for an efficient potato with late blight control. However, at the moment, it is difficult to perform an accurate identification of intraspecific variation of *P. infestans* by morphological feature (Tooly et al., 1997).

MATERIALS AND METHODS

The biologic material consisted of nine potato lines created at the Agricultural Research and Development Station of Suceava through an intraspecific hybridization which have proved to be valorous with regards to the resistance to diseases (viruses and late blight of

Table 1. The main traits of the tubers of the analysed potato lines.

Line	Main traits of the tubers
Sv 01-884-4	Light yellow flesh, round shape, shallow eyes, thin skin and large number of tubers from nest
Sv 01-884-8	Yellow flesh, round shape, shallow eyes and thin skin. The size of the tubers is medium
Sv 01-884-2	Light yellow flesh, oval shape, shallow eyes and thin skin
Sv 00-847-5	Light yellow flesh, round-oval shape, rough skin, shallow eyes and big yields.
Sv 00-847-22	Yellow flesh, round-oval shape and resistant to common scab
Sv 00-847-25	Yellow flesh, round-oval shape, shallow eyes and big yields.
Sv 99-789-11	Red flesh, round-oval shape, rough skin, quasi profound eyes, large number of tubers from nest
Sv 99-789-12	Yellow flesh, round-oval shape and quasi profound eyes. In the humid conditions, the tubers crack due to high accumulation rate.
Sv 99-789-10	Yellow flesh, round shape and quasi profound eyes. The size of the tubers is medium

Table 2. The vegetation period length.

Line	The sprouting time	The vegetation period length (days)
Sv 01-884-4	2.06	94
Sv 01-884-8	1.06	87
Sv 01-884-2	5.06	92
Sv 00-847-5	1.06	91
Sv 00-847-22	30.05	87
Sv 00-847-25	4.06	86
Sv 99-789-11	4.06	91
Sv 99-789-12	1.06	95
Sv 99-789-10	4.06	88
Astral	3.06	89

potato) and with a greater production capacity. The main traits of the potato lines are presented in Table 1. The experiment has been located in blocks with randomized structure plots, in three replications, and the plot surface was 16.8 m^2. The tubers have been planted manually at a distance of 30 cm on a row and 70 cm between rows, assuring a density of 47.6 thousands of plants on a hectare.

In the nurturing stage of the experiment, it should be noted that annual weeds were destroyed by chemicals using Dancor 1.2 l/ha. Other treatments have been carried out for the late blight of potato infection attenuation using Antracol 2 kg/ha, Bravo 2 kg/ha, Ranman 200 g/ha as contact fungicides and two treatments with systemic fungicides, using Secure 2 kg/ha and Tatoo C 21/ha. In order to combat the carrying aphides of viruses and the larva of the Colorado potato beetle, treatments were carrried out with the following insecticides: Actara (0.06 kg/ha) and Calypso (0.09 kg/ha). However, fertilization was carried out during the spring with 200 kg ammonium nitrate /ha (16:16:16) and 500 kg/ha, reaching 150 kg of Nitrogen, 80 kg of P_2O_5 and 80 kg of K_2O/ha. The soil type for the experiment is leached chernozem. Nevertheless, the interpretation of the results was done through the variance analyses (Ceapoiu, 1968). Concerning the thermo, the following aspects were observed:

1. The monthly averages have been close to the multiannual averages only in the months of April and August. In July, a supplementary caloric contribution was registered due to the temperatures from the third decade when its average was 22.4°C. As a consequence, the monthly average was 1.1°C bigger than the multiannual value;
2. In comparison with the multiannual average, the coldest month was June (0.6°C), and this was due to the coldness of the air from the first decade, of which the average had been only 14.0°C.

RESULTS

Concerning the influence of the meteorological conditions on the main levels of the potato vegetation, some extracts were made. The big wet soil in the month of May and its heating in the third decade of May (17.7°C) have favored the rapid increase of the tillers, making the flowering of the plants faster in the first days of May (17.7°C). Thus, it favored quick breeding of the tillers, thereby making the breeding of the plants faster in the first days of June. As a consequence, the breeding of plants takes place after 26 to 32 days from the plantation. From the tested lines, the earliest have been noticed for lines 00-847-22 (3005), 01-884-8, 00-847-5 and 99-789 - 12 (01.06) and the latest for lines 00-847-25, 99-789-11, 99-789-10 and 01-884-2 (04-05.06) (Table 2).

The notes done during vegetation, concerning the frequency of the infested bushes with easy viruses of the

Table 3. The observations concerning the resistance to late blight of potato and viroses.

Lines	The bushes frequency infected with viroses (total %)	The foliar tolerance at the late blight of potato attack (notes)*	
		18.07	4.08
Sv 01-884-4	6.0	8	8
Sv 01-884-8	12.9	7	7
Sv 01-884-2	2.5	6	6
Sv 00-847-5	5.6	8	8
Sv 00-847-22	4.2	7	7
Sv 00-847-25	0.5	9	9
Sv 99-789-11	27.3	8	8
Sv 99-789-12	8.0	9	8
Sv 99-789-10	3.2	8	7
Astral	13.4	9	9

* 1- the very small tolerance; 9- very tolerant.

mosaic type and the hard viruses (leaf rolling and streak mosaic), permit the outlining of the fact that the majority of the lines own a real resistance to the virotic degeneration. Among these, only line 99-789-11 would represent (after the data subscribed in Table 3) a notable sensitivity. Regarding the total production, beside the 01-884-4 line that has been attached with the maximum production, there are also lines 01-884-8 and 00-847-25 in the next levels that represent a great interest (Table 4).

In order to reach the synthetic valuation (Table 5) of the lines that are closely similar to the “agronomic index” used for maize, they have been given marks from one to five as follows:

1. Very unsatisfactory,
2. Unsatisfactory,
3. Average,
4. Good,
5. Very good.

DISCUSSION

The significant heating that began in the second decade of June and the pluviometrical regime that was favorable to plants but not interrupted in June have favored the acceleration of the developing rhythm of the plants. In this way, the partial recuperation of the negative influence was generated by the lasting plantation. When this was compared with that of June, the meteorological conditions from July and August have been very unfavorable for the reserve substance accumulation.

Concerning the vegetation period of the lines, it is observed that these lines frame themselves in the semi earlier genotypes group, and are similar to one of the Astral cultivar of 89 days. Among these lines, lines 00-847-25, 01-884-8 and 99-789-10 have been outlined through a shorter period (86 to 88 days) of the vegetation period in 7 to 8 days when compared with lines 01-8844 and 99-789-12 through its vegetation period of 94 to 95 days (Table 2). Taking into consideration the meteorological conditions of plants, it was observed that these conditions were more favorable for the presence of the pathogen pressure which has drastically increased in no time, and were also favorable for the attenuation of the late blight of potato attack against genotypes for the modification of the tolerance grade of the leaves in comparison with the attack produced by the fungus *P. infestans*.

Marking the forms with very high tolerance as 9 and those with a very low tolerance as 1, it can be observed that line 00-847-25 was presented in 2009 as the line that has the biggest tolerance conditions of the leaves for the asexual form of the late blight potato followed by line 00-789-11. However, the lowest tolerance has been presented by line 01-884-2 (Table 3).

Concerning the total production of tubers shown in Table 4, some observations were made:

1. In comparison with the decreasing average (241.1 t/ha), it was reported that only line 01-884-4 has been attached to the total production of 28 t/ha, and since line 01-884-8 registered an increase of 2.1 t/ha, it deserves to be retained at least a year for edification;
2. If the comparison is reached out by evaluating it with the less productive line (99-789-10), lines 01-884-4, 01-884-8 and 00-847-25 can be outlined through significant increases.

The four criteria (among which two are identical in this case) used in evaluating the decreases observed in the lines can contribute to the increase of the selection pressure. Consequently, through this process, the amelioration activity can be increased randomly. At the same time, they can contribute to the diminution of the elimination risk of a very valorous potential material.

Table 4. The tubers yield.

No.	Lines	The total yield (t/ha)	The comparative differences		X . 100 / X max	X . 100 / min
			With average	With standard		
1.	Sv 01-884-4	28.0	3.9^{x}	st	100 (st)	138 ^{xx}
2.	Sv 01-884-8	26.2	2.1	-1.8	93	129 ^{x}
3.	Sv 01-884-2	24.6	0.5	-3.4^{o}	88^{o}	121
4.	Sv 00-847-5	20.7	-3.4^{o}	-7.3^{oo}	74^{oo}	102
5.	Sv 00-847-22	23.2	-0.9	-4.8^{o}	83^{o}	114
6.	Sv 00-847-25	25.5	1.4	-2.5	91	126 ^{x}
7.	Sv 99-789-11	24.0	-0.1	-4.0^{o}	86 ^{o}	118
8.	Sv 99-789-12	24.9	0.8	-3.1	89	122
9.	Sv 99-789-10	20.3	-3.8^{o}	-7.7^{oo}	72^{oo}	100 (st)
10.	Average	24.1				
	Dl-5%		3.3		20%	27%
	Dl-1%		5.5		28%	38%
	Dl-0.5%		10.3		38%	50%
	Sv 01-884-4	14.2	1.5	mt	90	143
	Sv 01-884-8	15.7	3,0 ^{x}	1.5	100 mt	158 ^{x}
	Sv 01-884-2	14.4	1.7	0.2	92	145
	Sv 00-847-5	9.9	-2.8^{o}	-4.3 ^{o}	63^{o}	100 mt
	Sv 00-847-22	12.5	-0.2	-1.7	80	126
	Sv 00-847-25	12.7	-	-1.5	81	128
	Sv 99-789-11	14.0	1.3	-0.2	89	141
	Sv 99-789-12	10.8	-1.9	-3.4^{o}	69^{o}	109
	Sv 99-789-10	10.7	-2.0	-3.5^{o}	68^{o}	108
.	Average	12.7				
	Dl-5%		2.2		30%	48%
	Dl-1%		4.8		42%	67%
	Dl-0.5%		6.7		59%	92%

Table 5. The syntetic valuation of the descendants.

No.	Lines	The yield		Tolerance	
		Total	Commercial	To the late blight of potato	To viroses
1	Sv 01-884-4	5	4	4	4
2	Sv 01-884-8	4	5	4	1
3	Sv 01-884-2	3	4	3	5
4	Sv 00-847-5	1	1	4	4
5	Sv 00-847-22	3	3	4	5
6	Sv 00-847-25	4	3	5	5
7	Sv 99-789-11	3	4	4	1
8	Sv 99-789-12	3	2	4	4
9	Sv 99-789-10	1	2	4	5

Concerning the commercial production dimension (for alimentary use), a remark was made, in the first place, on line 01-884-8 that has been attached with the biggest production of big tubers (over 100 g). If it is taken into consideration that although line 01-884-8 had been over-reached with 1.8 t for the total production of line 01-884-4, whose commercial production had been overreached with 1.5 t/ha, it can be considered that line 01-884-8 can produce big tubers and can outline itself in other vegetation conditions.

Conclusions

The obtained results in year 2009 showed that line 01-884-4 had a very good random activity of tubers and a good tolerance for late blight of potato and viroses. Line 01-884-8 represents some notable qualities and can represent an interest for the areal with a virotic infestation that reduced drastically. However, line 00-847-25 can be considered “valorous” for any other uses if the random activity of big tubers is improved through other cultural methods.

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