

Full Length Research Paper

Genetic variability of features in some lines of potato in North-western plateau suceava

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The aim of this study was to evaluate the effect of temperate climate plant species and two different types of fertilizer on the yield components related to summer maize crop productivity in an area with a history of 5 years of soybean/black oat succession cropping in a no-tillage system in ArenitoCaiua, Northwestern Paraná State, Brazil. The experiment was conducted in split blocks, with 6 blocks and 16 treatments (8 winter crops and 2 types of fertilizer). The maize hybrid used was DKB 390PRO. The following yield components were evaluated: plant height and height of first-ear insertion; final plant population; ear length and diameter; number of rows per ear, number of grains per row and number of grains per ear; weight of 100 grains and yield. It can be concluded that all succession systems are agronomically viable for maize production in the ArenitoCaiua region, in conjunction with adequate crop nutrition management, especially the winter common vetch/summer maize succession system fertilized with poultry litter which produced the best maize yield.

Key words: Potato, yield component, fertilizer.

INTRODUCTION

Potato has probably more related wild species than any other crops, since the genus *Solanum* comprises around 2000 species (Hawkes, 1990). Potato breeders usually use wild *Solanum* species as sources of disease resistance genes (Hijmans and Spooner, 2001). The cultivated potato in Europe, having the origin in the South and Central America, cannot have the possibility to improve the genetically material with the other species of *Solanum* genus and evaluated as a low number of genotypes (Hawkes, 1990). The variety is a main resource for increasing the yield, without supplementary cost and energy (Bodea, 1994).

The improving of the cultivars sets with this new genotype, represents one of the most efficient ways for increase of the yield productivity, quality and stability, and

which less suffer because of less favorable biotic factors (Grădinaru et al., 1986). Back crosses 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 Negulescu, 1983). Revealing of the genetic variability of local populations of *Pythophthora infestans* is a crucial step for an efficient potato late blight control. At the moment is difficult to perform an accurate identification of intraspecific variation of *P. infestans* by morphological feature (Tooly et al.,

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

1997). The main aim of this study is to identify "valorous" potato lines in order to use it in different hybrids combination.

MATERIALS AND METHODS

The biologic material consisted of nine potato lines created at Agricultural Research and Development Station of Suceava through an intraspecific hybridization that have proved to be valorous concerning the resistance to diseases (viruses and late blight of 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 a randomized structure plots, in three replications, the plot surface was 16.8 m². The tubers have been planted manually at a distance of 30 cm on a row and 70 cm between the rows, assuring a density of 47.6 thousands of plants on a hectare.

As nurturing work, there should be mentioned the chemical destruction of the annual weeds, that has been carried out with Dancor 1.2 l/ha. There have been done some treatments 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 larva of the Colorado potato beetle, there have been done for treatments with the following insecticides: Actara 0.06 kg/ha and Calypso 0.09 kg/ha.

The fertilization has been carried out during the spring with 200 kg ammonium nitrate /ha (16:16:16), 500 kg/ha, reaching 150 kg of Nitrogen, 80 kg P₂O₅ and 80 kg K₂O /ha. The soil type on which there has been placed the experience is leached chernozem. The interpretation of the results has been done through the variance analyses (Ceapoiu, 1968).

Concerning the thermo regime it could be mentioned the following aspects:

- i) The monthly averages have been close to the multiannual only in April and August.
- ii) In July there has been registered a supplementary caloric contribution, due to the temperatures from the third decade, when its average was of 22.4°C, as a consequence of the monthly average was 1.1°C bigger than the multiannual value.
- iii) In comparison with the multiannual average, the coldest month has been June (0.6°C), and this is due to the coldness of the air from the first decade, of which average has been only of 14.0°C.

RESULTS

Concerning the influence of the meteorological conditions on the main levels of the potato vegetation there can be outlined some aspects: the big wet of the soil in May, and also 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) have favored quick breading of the tillers, making the breading of the plants faster in the first days of June. As a consequence the plants breeding has taken place after 26 to 32 days from the plantation.

From the tested lines, the earliest has been noticed at 00-847-22 (3005), and also to 01-884-8, 00-847-5 and 99-789 -12 (01.06) and the latest for the lines 00-847-25, 99-789-11, 99-789-10 and 01-884-2 (04-05.06) (Table 2).

The notes taken during the vegetation concerning the frequency of the infested bushes with easy viruses of the mosaics type and the hard viruses (leaf rolling, 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 the line 99-789-11 would represent (after the data subscribed in the Table 3) a notable sensitivity.

Regarding the total production, beside the 01-884-4 lines that have been attached with the maximum production there are also the lines 01-884-8 and 00-847-25 for the next levels that represent a great interest (Table 4).

In order to reach the synthetic valuation (Table 5), closely similar to the "agronomic index" used for maize, there have been given marks from 1 to 5, as following:

- i) Very unsatisfactory,
- ii) Unsatisfactory
- iii) Average
- iv) Good,
- iv) Very good.

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

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

Line	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.

DISCUSSION

The significant heating that has been registered beginning with the second decade of June, and also the pluviometrical regime favorable and not interrupted in June have favored the acceleration of the developing rhythm of the plants, and this way the partial recuperation of the negative influence generated by lasting of the plantation. Comparative with June, the meteorological conditions from July and august have been very unfavorable for the reserve substance accumulation.

Concerning the vegetation period of the lines, there should be appreciated that these frame themselves in the semi earlier genotypes group, being alike to the one of the Astral cultivar of 89 days, among these, the lines 00-847-25, 01-884-8,99-789-10, there have been outlined through a shorter period (86-88 das) of the vegetation period of 7 to 8 days , comparative with the lines 01-8844 and 99-789-12 with its vegetation period of 94 to 95 days (Table 2). Taking into consideration, the meteorological conditions have been more favorable for the presence of the pathogen pressure that has been very increased, and

also for the attenuation of the late blight of potato attack for the genotypes port for the modification of the tolerance grade of the leaves in comparison with the attack produced by the fungus *P. infestans*.

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

Concerning the total production of tubers, subscribed in the Table 4, there can be outlined some aspects:

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

Table 4. The tubers yield.

S/N	Line	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				
	DI-5%		3.3		20%	27%
	DI-1%		5.5		28%	38%
	DI-0.5%		10.3		38%	50%

S/N	Line	The total yield (t/ha)	The comparative differences		X ₁₀₀ X _{max}	X ₁₀₀ min
			With average	With standard		
1.	Sv 01-884-4	14.2	1.5	mt	90	143
2.	Sv 01-884-8	15.7	3.0 ^x	1.5	100 mt	158 ^x
3.	Sv 01-884-2	14.4	1.7	0.2	92	145
4.	Sv 00-847-5	9.9	-2.8 ^o	-4.3 ^o	63 ^o	100 mt
5.	Sv 00-847-22	12.5	-0.2	-1.7	80	126
6.	Sv 00-847-25	12.7	-	-1.5	81	128
7.	Sv 99-789-11	14.0	1.3	-0.2	89	141
8.	Sv 99-789-12	10.8	-1.9	-3.4 ^o	69 ^o	109
9.	Sv 99-789-10	10.7	-2.0	-3.5 ^o	68 ^o	108
10.	Average	12.7				
	DI-5%		2.2		30%	48%
	DI-1%		4.8		42%	67%
	DI-0.5%		6.7		59%	92%

Table 5. The syntetic valuation to the descendants.

S/N	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

outlined through significant increases.

The four criteria (among which two are identical in this case) of evaluation of the decreases can contribute to the

increase of the selection pressure and through this to the increase of the random of the amelioration activity. In the same time they can contribute to the diminution of the

elimination risk of a very valorous potential material.

Concerning the commercial production dimension (for alimentary use) there can be remarked in the first place, the 01-884-8 line that has been attached with the biggest production of big tubers (over 100 g). If there is taken into consideration the fact that although this line (01-884-8) has been over reached with 1.8 t/ha for the total production for the line 01-884-4 and that for the commercial production there is an overreach of 1.5 t/ha, there can be considered that the line 01-884-8 can produce big tubers and can outline herself in other vegetation conditions.

Conclusion

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

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