



Pavelsko – a new Bulgarian potato variety suitable for chips

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Abstract

The variety Pavelsko is bred in the Maritsa Vegetable Crops Research Institute, Plovdiv, by the method of individual clone selection in the hybrid progeny of Britta and line ML 75.25/18yN. It is approved by the Executive Agency for Variety Testing, Approbation and Seed Control, Sofia in 2014. Mid-early variety suitable for mid-early and late production. The variety forms 11–13 mid-large tubers. They are round-oval with yellow netlike skin, shallow eyes and yellow flesh. They possess russet gene determining their high adaptability for industrial processing. The dry matter content is within 25 – 26%, starch 18 – 19% and reducing sugars 0.15 – 0.20%. It is characterized with very good taste and non-discolored flesh. Pavelsko is suitable for fresh consumption and chips. The variety possesses high field resistance to virus diseases and tuber blight. It is resistant to potato cyst nematodes *Globodera rostochiensis*. It is stored very well during winter-spring season.

Keywords: potato, breeding, varieties, chips, nematode resistance

Introduction

The potato is grown in more than 150 countries with an average yield of about 16 tons ha⁻¹ (Wang, 2008). However, yields in North America and some European countries are over 40 tons ha⁻¹, even 70 to 80 tons ha⁻¹ can be realized in experimental plots. The yield in developing countries is less than 20 tons ha⁻¹, even less than 10 tons ha⁻¹ in some countries. There is a big gap among the various countries between high and low yields, even with the same variety of potato.

During the last years the areas that are occupied by potatoes in Bulgaria were reduced to 150 000 da, with an average yield 1300-1800 kg da⁻¹. The cultivars structure of our potato production is presented mainly by Dutch and German breeding, while the Bulgarian cultivars are fewer than 10 per cent. The diverse and often extreme climatic conditions (Petkova and Nacheva, 2001) of individual regions, the high infectious background in the country (Muletarova and Nacheva, 1995) and the low propagation coefficient of the crop impose the use of a great set of cultivars. The annual

imports of seed potatoes contributes to the emergence of several new diseases and pests - potato cyst nematodes *G. rostochiensis* (Trifonova and Blagoeva, 2008) and *G. pallida* (Samaliev et al., 1995), new virus strains (Petrov et al., 2008) and pathotypes of pathogens (Nikolov et al., 2008).

The area augmentation and potato consumption in Bulgaria, the increased requirements of growers, consumers, processors and the limited set of Bulgarian varieties for the particular production directions imposed the development of new potato varieties for consumption and industrial processing with high biological potential for yield and quality, resistant to biotic and abiotic factors of stress and meeting the national peculiarities, demanding buyer's taste (Nacheva, 2009).

The purpose of the present study is to be performed agrobiological and economic evaluation of the characters and qualities of the new variety Pavelsko, bred in the Maritsa vegetable crops research institute.

Table 1. Morphological characteristics of varieties Pavelsko and Sante

Characters	Pavelsko		Sante	
	x	CV%	x	CV%
Number of stems per plant	4.5	13.1	4.0	12.5
Number of tubers per stem	2.8	11.1	2.2	11.9
Number of tubers per hill	12.6	13.7	8.8	15.5
Standard tuber number per hill	9.7	12.6	6.8	13.2
Non-standard tuber number per hill	2.9	10.3	2.0	12.5
Average tuber weight (g)	75.3	21.5	82.4	30.3
Average tuber weight per hill (kg)	0.766	29.1	0.623	32.1
Shape of tubers (index)	108.6	15.7	119.1	20.7
Shallowness of eyes (scale 0-9)	7.8	10.9	8.2	11.0

Table 2. Three-factorial analysis of variance of total yield

Source of variation	df	Mean square	F-value	Influence %
Total	71			
Genotype	1	3.97	179.68***	15.3
Year	2	0.96	43.78***	7.4
Ecological zone	2	3.39	153.92***	26.1
Genotype x year	2	0.15	5.24**	0.9
Genotype x ecological zone	2	1.07	46.29***	7.8
Year x ecological zone	4	0.45	20.52***	7.0
Genotype x year x ecological zone	4	2.05	90.98***	30.9
Error	54	0.02		4.6

*** p ≤ 0.001

Table 3. Economic characteristics of varieties Pavelsko and Sante

Characters	Pavelsko	Sante
	x ± sd	x ± sd
Duration of vegetation period	106.3 ± 9.7	105.5 ± 10.8
Standard yield (kg da ⁻¹)	3009 ± 521	2412 ± 549
Total yield (kg da ⁻¹)	3224 ± 609	2628 ± 731
% standard produce	93.3 ± 2.1	91.7 ± 2.2
Standard yield compared to control	124.8	100
Total yield compared to control	122.7	100
Resistance to rhizoctoniose	0.63 ± 0.30	2.10 ± 0.25
Resistance to common scab	0.85 ± 0.10	3.82 ± 1.30
Resistance to leaf blight	0.83 ± 0.07	1.95 ± 0.47
Resistance to tuber blight	0.95 ± 0.05	1.57 ± 0.10
Resistance to PLRV	5.7 ± 1.05	5.8 ± 1.8
Resistance to PVX	3.1 ± 0.55	8.2 ± 1.10
Resistance to PVY	6.3 ± 0.60	8.2 ± 0.95
Resistance to <i>Globodera rostochiensis</i>	2.05-2.95	2.10-3.05

Materials and Methods

The investigation was performed during the period 2009 – 2011 in the experimental field of the Maritsa vegetable crops research institute – Plovdiv. The variety Pavelsko is bred by the method of individual clone selection in the

hybrid progeny of Britta and line ML 75.25/18yN. It is approved by the Executive Agency for Variety Testing, Approximation and Seed Control, Sofia in 2014.

Table 4. Chemical-technological and organoleptic characteristics of varieties Pavelsko and Sante

Characters	Pavelsko	Sante
	x ± sd	x ± sd
Dry matter contents (%)	25.3 ± 2.32	22.3 ± 2.94
Starch contents (%)	18.3 ± 1.44	16.8 ± 1.57
Reducing sugar contents (%)	0.16 ± 0.02	0.48 ± 0.08
Quality of boiled potatoes	3.95 ± 0.61	3.80 ± 0.55
Quality of chips	4.75 ± 0.53	4.10 ± 0.48
Quality of French fries	4.15 ± 0.58	4.25 ± 0.47

Morphological and economical characteristics of the new variety includes characters grounded on the methods of the Executive Agency for Plant Variety Testing, Approbation and Variety Maintenance for Distinction, Homogeneity and Stability which is harmonized with the UPOV requirements. For testing of the productive potential of the variety Pavelsko is set three-factor field experiment by block method in four replications at drilling distance 70/25 cm and size of the experimental plot 250 m². The following factors were studied:

A - genotypic differences with 2 treatments: variety Pavelsko and a control for the mid-early group of maturity variety Sante.

B – year of study: 2009 – 2011

C – ecological regions with three classes: Plovdiv's region, located in the Highthracian plain, along the Maritsa river valley, altitude 160 m; region of the village of Pavelsko, located in Rodopes mountain at altitude 600 m; the region of peak Pashaliitsa, situated in Rodopes mountain at altitude 1600 m.

Experiments are performed according to the agricultural practices for mid-early field potato production, adopted in Bulgaria.

During the vegetation are made observations for the occurrence of the main phenophases of potato plants and is estimated the continuation of vegetation period from planting to drying of above-ground mass. The response of susceptibility at natural background for infestation to fungal diseases leaf and tuber

blight (*Ph. infestans*), early blight (*Alternaria solani*), rhizoctoniose (*Rhizoctonia solani*) by recording the extent of damages by 0-4 scale (Mckiney) was studied. The field resistance to viral diseases PLRV (potato leaf roll virus), PVX (potato virus X), PVY (potato virus Y) is determined by recording the index of damage (0-9 scale). The resistance to potato cyst nematodes *G. rostochiensis* and *G. pallida* is determined by coefficient (Pf/Pi) under Ordinance № 17 of 3 June 2010 for control of potato cyst nematodes.

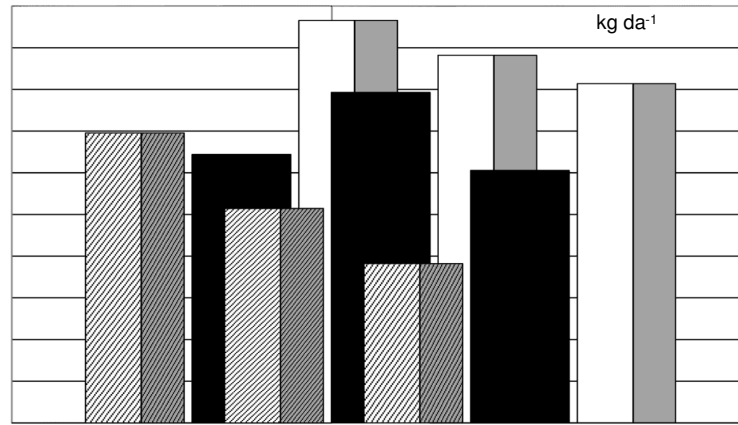
At harvesting of the treatments are recorded the characters tuber number per hill, tuber weight per hill (kg), tuber shape (length x 100/ diameter), eye depth (1-9 scale), standard and total productive (kg da⁻¹), percentage standard produce.

Of an average sample from 20 tubers is determined dry matter contents (by weight), starch (calculated by Reiman) and reducing sugars (Shoorl - Reggenbogen) from each treatment are prepared chips, French fries and boiled potatoes to which is made a panel test on the indices appearance, aroma, colour, texture and taste.

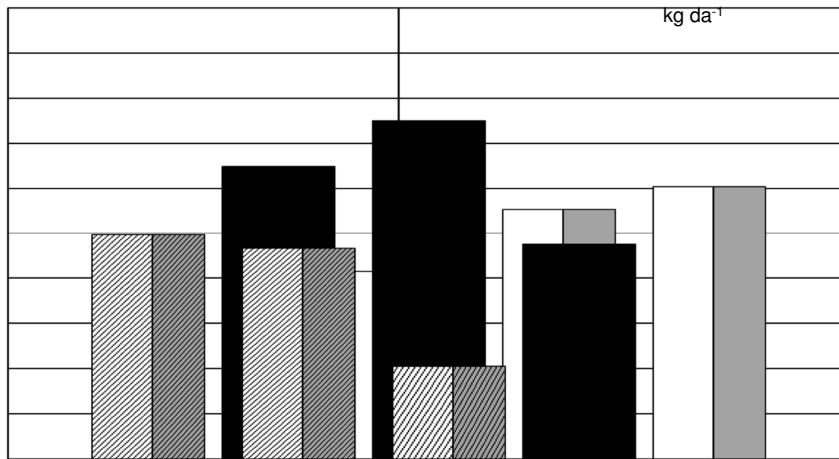
All data are processed statistically (Lakin, 1990).

Results and Discussion

The summarized data from agrobiological study of the varieties Pavelsko and Sante show considerable differences in the expression of some principle morphological characters (Table 1). In comparison with the control Pavelsko distinguishes by greater number of stems per plant (4.5) and greater tuber number per stem (2.8) as a result of which in one cluster forms almost 4 tubers more than Sante but with lower average weight (75.3 g). The variety forms 12.6 mid-large tubers which are round-oval (index 108.6) with shallow eyes (7.8) and yellow flesh. The skin is yellow, slightly rough with the presence of russet gene, which is correlatively related with the high suitability of Pavelsko for industrial processing and is one of the characters for variety distinction. Excluding the character stem number per plant variation coefficients of the remaining are lower in variety Pavelsko, which is an indication for its relatively higher stability in the change of the environment conditions.



Pavelsko



Sante

Figure 1. Total yield (kg da^{-1}) of varieties Pavelsko and Sante

The average tuber weight per cluster in variety Pavelsko is by 143 g higher compared to the control. Because of the genotypic homogeneity of the potato varieties follow that the recorded comparatively high variability of this character in both varieties ($\text{CV} = 29.1\text{--}32.1\%$) is due to the effect of the ecological factors and the genotype \times environment interaction. In this way the observed phenotypic variability by years and ecological zones of the character total yield could be also explained (Fig. 1). The proof for the made supposition is found in the results from the performed three-factorial analysis of variance (Table. 2). Data from the analysis of the variance show that the

differences in the productivity are defined by the different inheritance potential of both varieties. The strength of influence of this factor is 15.3%. Despite of the genotypic determination of the studied character a considerable effect on it exert the environment conditions. The phenotypic variation of the productivity in tested varieties is due to a great extent to soil and climatic differences in the regions of cultivation (26.1%) and the interaction of the genotype with the factors year and ecological zone (30.9%). The conditions of year though proved are characterized by lower strength of influence (7.4%).

In comparison of the values of the arithmetical means of both varieties (Table 3.) are established differences not only in total but also in their standard productivity. Pavelsko is distinguished by higher percentage of standard produce (93.3%) as a result of which surpasses the total yield of the control by 22.7% and the standard one by 24.8%.

The advantage of the new variety is the higher resistance to fungal diseases – common scab (*Streptomyces scabies*), leaf and tuber blight (*Ph. infestans*), rhizoctoniose (*Rhizoctonia solani*) (0.85, 0.83, 0.95 and 0.63) compared to the control (3.82, 1.95, 1.57, 2.10) and relatively high field resistance to viral diseases.

Progress for the Bulgarian potato breeding is resistance to economically most important soil pathogen – potato cyst nematode *Globodera rostochiensis*. Coefficient (Pf/Pi) of the new variety Pavelsko is 2.05-2.95, which defines it as a variety with high level of resistance with a value of 8.

The results from the chemical analysis of the tubers (Table 4.) show that Pavelsko is characterized by significant higher content of dry matter (25.3%) and starch (18.3%) than Sante (22.3; 16.8%). The recorded values of both indices completely meet chemical and technological requirements for the production of chips and classify the varieties as suitable for industrial processing. An additional advantage of the new variety is the triple lower of reducing sugars (content 0.16%) compared to the control (0.48%) as a result of which the obtained in frying potato products are distinguished by intensively golden yellow color and receive excellent organoleptic evaluations (4.75).

Conclusion

The agrobiological evaluation made of the potato variety Pavelsko show that is bred an original genetic plasm characterized with valuable morphological characters.

The higher productive potential of the new variety, its resistance to some economically important for the country diseases and pests, and the improved chemical and technological, as well as taste qualities give us a reason to guarantee its competitive power on Bulgarian market.

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