



## Yasen F<sub>1</sub> – New Bulgarian Pepper Variety

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### Abstract

A new pepper variety Yasen is bred at the “Maritsa” Vegetable Crops Research Institute, Plovdiv, Bulgaria. The F<sub>1</sub> hybrid is developed as a result of combining of genic male sterility and heterosis effect. It is suitable for greenhouses, early and mid-early field production. The fruits are drooping, predominantly with one apex, light green before maturity and red at botanical maturity. The fruit exocarp is very thin, tender in fresh consumption. The fruit shape is moderately triangular in longitudinal section. The produce is suitable for fresh consumption and processing. During the period 2004-2007 the new variety was compared with standard one Zlaten medal 7 and parental component by some economic and morphological characters. Yasen F<sub>1</sub> significantly exceeded parent line by earliness, total and marketable yield and standard variety by total and marketable yield. The vegetative period of new variety was 106 days from germination to first harvest. This variety formed mid-high (55.66 cm) plants with strong stem (15.39 cm) and 3 branches from first order. The fruit length was on average 11.58 cm, the diameter at the base – 4.72 cm, pericarp thickness – 3.90 mm and fruit weight - 76.01 g.

**Keywords:** *Capsicum annuum* L, hybrid, male sterility, yield, fruit

### Introduction

The variety is one of the main components in the technological decision for each crop. Development of correct variety structure depending on the concrete agroecological conditions of the region could increase considerably the yield and quality of the produce. That's why the farmers and the producers should know very well the characteristics of the individual varieties to make their correct choice.

The number of the developed and offered F<sub>1</sub> pepper hybrids increases constantly (Cvikic et al., 2006a, 2006b; Crosby et al., 2013). Male sterility is one of the most important characters used in hybrid pepper breeding. Application of male sterility reduces hybrid production costs by excluding the need for manual emasculation of maternal line and elimination of impurities of the seed material originated from self-pollination (Bartoszewski et al., 2012). The first Bulgarian pepper hybrid varieties on the genic male sterile base have been developed before more than 30 years. They were: Krichimski ran F<sub>1</sub> (Dascalov and Milkova, 1976), Lyulin F<sub>1</sub> (Milkova and Dascalov, 1984) etc. Unfortunately because of a number of objective and subjective reasons these varieties were not established in the practice.

In the Maritsa VCRI it was worked from many years by breeding programme for development of F<sub>1</sub> pepper hybrids by applying of heterosis effect in combination with genic male sterility (Nikolova et al., 2001, 2002; Todorova, 2001; 2002). As a result from the efforts in this direction was the first hybrid pepper variety on male sterility basis created in the Maritsa VCRI – Yasen F<sub>1</sub>. It is developed by hybridization between maternal line 1647 possessing nuclear male sterility gene *ms8* and parental line 1175/07. Yasen F<sub>1</sub> is high yielding, suitable for greenhouse conditions, early and mid-early field production. The variety is with proven low susceptibility to the pathogen *Verticillium dahliae* Kleb. (Masheva and Todorova, 2013). The fruits are drooping; wide conical with one apex and average weight 75 g, long 12-14 cm and wide 5-6 cm. Before maturity they are light green and after maturity - red. The skin is thin and tender in fresh consumption. Total yield is 40-60 t ha<sup>-1</sup> and marketable - 35-50 t ha<sup>-1</sup>. Yasen F<sub>1</sub> is suitable for fresh consumption and for processing - frying, stuffing etc.

The purpose of the study was to be performed agro biological and economic evaluation of the new pepper variety Yasen F<sub>1</sub> in comparison with his parental line 1175/07 and standard one Zlaten medal 7.

## Materials and Methods

Hybrid Yasen F<sub>1</sub>, parental component - line 1175/07 and variety Zlaten medal 7 as a standard for early field production were tested in the experimental plot of the Maritsa Vegetable Crops Research Institute during the period 2004-2007. The sowing of the materials was made in unheated greenhouses during the period 24 of March to 4 of April in the different years. The planting was performed within 13-31 of May on alluvial meadow soil and furrow surface by 70/15 cm scheme. The experiment was set by block method in four replications (40 plants in replication). The plants were grown by the adopted technology for mid-early production.

The studied materials were estimated by next morphological and economic characters – plant height (cm), stem height (cm), branches from first order (number), fruit length (cm), diameter at the fruit bottom (cm), pericarp thickness (mm), fruit weight (g), edible fruit part (%), earliness, including harvests up to 30 days after the first harvest, total and marketable yield (kg da<sup>-1</sup>). It was analyzed 20 plants, respectively fruits from the plants, which were chosen randomized from each replication. Biometrical measurements of the plants were made after finishing of the active vegetative growth. The harvests were performed before maturity of the fruit.

According to requirements of International union for the protection of new varieties of plants (UPOV, 2006) and later Community Plant Variety Office (CPVO, 2007) were conducted visual observations of groups of plants and fruits of Yasen F<sub>1</sub> and standard variety Zlaten medal 7 for assessment by distinctness, uniformity and stability tests.

Two-way analysis of variance (Lidanski, 1988) and Duncan's multiple range test (1955) were applied for data processing. The influence (η, %) of the variation factors on the manifestation of the studied characters also was evaluated.

## Results and Discussion

The data from two-way analysis of variance showed that the phenotypic expression of the total and marketable yield and earliness was depended on all systematic sources of variation – genotype, year and interaction genotype x year (Table 1). The influence of the sources on the total yield was relatively close – from 29.67% to 37.03%. The influence of the year was determining for marketable yield (45.74%) while the genotype differences were decisive for the earliness (42.95%).

During the whole experimental period the new variety demonstrated significantly higher values by yield and earliness compared to parental component - breeding line 1175/07 (Table 2).

Yasen F<sub>1</sub> was with 14.97% significantly higher total yield in comparison with the standard variety and with 16.37% more marketable one. The new variety did not differ from Zlaten medal 7 by earliness and vegetative period from germination to first harvest - 106 days (Fig. 1).

The obtained results from two-way analysis of variance revealed that genotype differences and year conditions were with proven role on the variability of all studied morphological characters (Table 3). The interaction genotype x year had no proven effect only on the manifestation of branches of the first order on the plant and fruit pericarp thickness. It was established that the genotype differences were with determining influence on the variability of plant stem – 63.01%, fruit weight - 57.45%, fruit length 60.96%, fruit diameter – 79.40% and thickness of the pericarp – 45.94% (Table 4). The years of cultivation were prevailing factor on the phenotypic expression of plant height – 70.43%, branches of the first order – 48.01% and edible part of the fruit - 54.94%. The influence of the interaction genotype x year was from 4.14% for plant stem to 11.70% for edible part of the fruit.

**Table 1.** Two-way analysis of variance on yield and earliness

Sources of variation	Degree of freedom	Total		Marketable		Earliness	
		Mean square	influence	Mean square	influence	Mean square	influence
Genotype	2	2061524.07***	30.35	2650625.33***	28.16	1909268.08***	42.95
Year	3	1343355.99***	29.67	2870846.67***	45.74	767837.86***	25.91
Genotype x Year	6	838417.75***	37.03	780462.67***	24.87	396767.19***	26.78
Residual	36	11146.31		6439.28		10788.19	

\*\*\* - P<0.001

**Table 2.** Estimation of pepper genotypes by yield and earliness

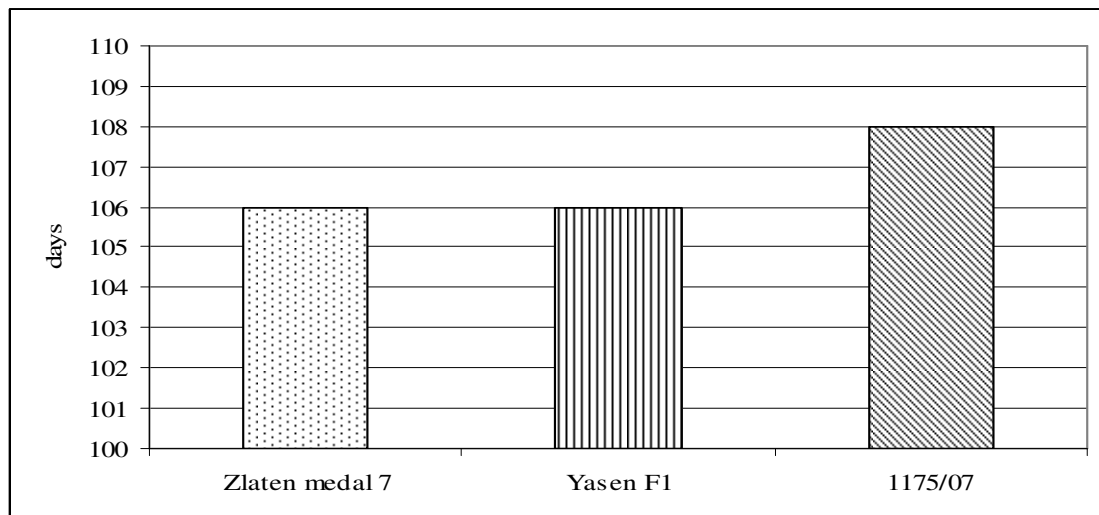
Genotype	Total			Marketable			Earliness		
	kg da <sup>-1</sup>	%	%	kg da <sup>-1</sup>	%	%	kg da <sup>-1</sup>	%	%
Zlaten medal 7	3628.86 b	100	103.86	3201.00 b	100.00	109.49	2477.38 a	100.00	124.79
Yasen F1	4172.02 a	114.97	119.41	3725.00 a	116.37	127.42	2651.25 a	107.02	133.55
1175/07 ♂	3493.91 b	96.28	100.00	2923.50 c	91.33	100.00	1985.25 b	80.14	100.00

a, b, c – Duncan’s multiple range test (p<0.01)

**Table 3.** Two-way analysis of variance on morphological characters

Sources of variation	Degree of freedom	Mean square							
		Height		Branches of the first order	Fruit				
		Plant	Stem		Length	Diameter	Pericarp thickness	Weight	Edible part
Genotype	2	689.17***	260.90***	1.08***	152.44***	19.16***	3.89***	5298.12***	21.06**
Year	3	1732.41***	62.43***	1.56***	39.34***	0.86***	0.87**	1795.40***	88.46***
Genotype x Year	6	71.83***	5.71*	0.14ns	8.39***	0.49**	0.17ns	284.22***	9.42*
Residual	36	10,35	2,35	0,06	0,75	0,12	0,15	21,01	3,31

\* - P<0.05; \*\* - P<0.01; \*\*\* - P<0.001; n.s. – non significant



**Figure 1.** Vegetative period from germination to first harvesting

**Table 4.** Influence of the variation factors on variability of morphological characters (%)

Sources of variation	Height		Branches of the first order	Fruit				
	Plant	Stem		Length	Diameter	Pericarp thickness	Weight	Edible part
Genotype	18,68	63,01	22,15	60,96	79,4	45,94	57,45	8,72
Year	70,43	22,62	48,01	23,59	5,33	15,36	29,2	54,94
Genotype x Year	5,84	4,14	8,51	10,06	6,09	-	9,25	11,7

**Table 5.** Estimation of pepper genotypes by morphological characters

Genotypes	Height		Branches from first order	Fruit				
	Plant	Stem		Length	Diameter	Pericarp thickness	Weight	Edible part
	cm	cm	number	cm	cm	mm	g	%
Zlaten medal 7	58.10 a	18.32 a	2.78 b	13.72 a	3.56 c	3.40 b	53.50 c	82.02 b
Yasen F <sub>1</sub>	55.66 a	15.39 b	3.02 ab	11.58 b	4.72 b	3.90 ab	76.01 b	83.00 ab
1175/07 ♂	45.71 b	10.34 c	3.30 a	7.64 c	5.75 a	4.39 a	89.52 a	84.31 a

a, b, c – Duncan's multiple range test (p<0.01)

**Table 6.** Assessment on the base of distinctness, uniformity and stability test

No	Character	Yasen F <sub>1</sub>	Zlaten medal 7
1	Plant: length of stem	medium	medium to long
2	Stem: intensity of anthocyanin coloration of nodes	strong	medium
3	Leaf: length of blade	medium	short to medium
4	Fruit: shape in cross section (at level of placenta)	circular	eliptic
5	Fruit: texture of surface	slightly wrinkled	smooth or very slightly wrinkled
6	Stalk: length	medium	long to medium

On the basis of summarised data for the investigated period it was established that new variety Yasen F<sub>1</sub> demonstrated significant differences from its parental component and standard variety Zlaten medal 7 by most of the studied characters of the plant and fruit (Table 5). It formed mid-high plants (55.66 cm) and stem (15.39 cm), 3 branches of the first order on the plant. The fruit length was on average 11.58 cm, the diameter at the base – 4.72 cm, the pericarp

thickness of the fruit – 3.90 cm, the fruit weight – 76.01 g and edible part of the fruit – 83%.

From the visual assessment conducted by distinctness, uniformity and stability test in accordance with requirements of UPOV and CPVO it was established that Yasen F<sub>1</sub> is distinguished by six characters of plant and fruit morphology by comparison with variety Zlaten medal 7 (Table 6).

These results were very hopeful and therefore Yasen F<sub>1</sub> was offered as a candidate and

after two years successfully testing in the Executive Agency for Variety Testing, Approbation and Seed Control it was approved in 2012.

### Conclusion

The conducted comparative agro-biological evaluations showed that original gene plasma with valuable morphological and economical characters was developed.

The new hybrid variety combining genic male sterility and heterosis effect exceeded standard variety Zlaten medal 7 by total yield with 14.97% and marketable one – 16.37%.

The benefits of the new variety Yasen F<sub>1</sub> are a guarantee for its successful introduction into production which will improve the cultivar structure of pepper vegetable crop.

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