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Comparison of Several Watermelon (C*itrullus lanatus* Thunb.) Hybrids in Republic of Macedonia

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Abstract

Watermelon is a traditionally grown vegetable in the Republic of Macedonia. Numerous varieties and hybrids of watermelon are registered in the National Variety List. Prior to their introduction into commercial production, all foreign hybrids and newly created varieties are examined in order to determine their stages of growth, yield and characteristic of fruit. The experiment was set on experimental plots in the Institute of Agriculture in Skopje. In the years between 2005 and 2009, the following 21 varieties and hybrids of watermelon were observed: Romanza F_1, Bambolino F_1, Bonta F_1, Scherezada in 2005; Pauline F1, Nelson F1, Joker F_1, Carmen F_1 in 2006; Lady F_1, Trophy F_1, Fletta F_1, Marabella F_1, Super Crimson Sweet OP, Fantasy F_1 in 2007; Crimson Ruby F_1, Biblos F1, Pegasus F1, Megan F1 in 2008; Colosseo F_1, Caravan F_1, Montana F_1 in 2009. The Crimson Sweet was used as a standard variety. In 2005, Bambolino F_1 gave higher yield (59.7t/ha) than the standard variety (31.42t/ha). In 2006, Nelson F1 exceeded significantly higher yield by giving 65,8 t/ha in comparison to standard variety 46.3 t/ha. In 2007 all examined varieties gave better results than the standard variety. In 2008 Crimson Ruby F_1 gave higher yield (42.7 t/ha) than the standard variety (36.8t/ha). In 2009 Montana F_1 was more yielded (67.5 t/ha) then the standard variety (62.2 t/ha). All examined varieties and hybrids gave stable characteristics and were registered in the National Variety List for commercial production.

Key words: watermelon, hybrids, yield

Introduction

Watermelon (*Citrullus lanatus*) is one of the most widely cultivated crops in the world (Huh et al., 2008). FAO lists watermelon production in 101 countries (Maynard et al., 2007). Its global consumption is greater than that of any other

cucurbit. It accounts for 6.8% of the world area devoted to vegetable production (Guner & Wehner, 2004; Goreta et al., 2005). Watermelon is a traditional crop in the vegetable production of the Republic of Macedonia. It is cultivated in all parts of Macedonia due to its adaptability to a range of soil and climate. Statistical data show that watermelon and melon together are cultivated on a total area of 5 800 ha with total production of 127 449 t (State Statistical Office, 2012).

The fruit of watermelon undergoes distinct stages of development with dramatic changes in its size, color, sweetness, texture and aroma. The objective of this study was to determine the yield and yield components in watermelon hybrids grown in open field.

Materials and methdos

The field experiment was carried out during five growing seasons from 2005 to 2009, at the experimental fields of the Institute of Agriculture, in order to investigate the stages of growth, yield and fruit characteristics. During vegetation, the following dates of the stages of growth were recorded: date of sowing, date of sprouting, date of first harvest. The vegetation period was measured in number of days from the date of sprouting to the date of fist harvest. The yield was measured as a mass of the fruits per area of experimental plot in 5 replications (2005 and 2007), 4 replications (2006) and 3 replications (2008 and 2009). During the vegetation the following characteristics of the fruit were measured: mass (kg), index of fruit, thickness of rind (mm), fruit utilization (%), content of sugars (%), colour of the flesh, consistency, sweetness of the flesh and juiciness of the flesh. A total of 21 watermelon varieties/ hybrids were included in this trial. All investigated hybrids were compared with one standard variety: Crimson Sweet. The study was carried out in a randomised complete block design, where the unit plot size was 20 m². The technology was standard for growing watermelon in open field. In 2005, four hybrids of watermelon with the following names were analyzed: Romanza F1, Bambolino F1,

Bonta F1, Scherezada. They were compared with the standard variety Crimson Sweet. During the trial in 2006, a total of four varieties were observed: Pauline F1, Nelson F1, Joker F1, Carmen F1, all compared with the same standard variant. As plant material for 2007, six hybrids of watermelon were used: Lady F1, Trophy F1, Fletta F1, Marabella F1, Super Crimson Sweet OP and Fantasy F1. In 2008, four varieties were examined: Crimson Ruby F1, Biblos F1, Pegasus F1 and Megan F1. During the vegetation in 2009, hybrids assigned as Colosseo F1, Caravan F1 and Montana F1 were used as plant material for the necessary experiments. All data were subjected to the analysis of variance (ANOVA) using the least significant difference (LSD).

Results and discussion

This paper reviews the five-year average values of the yield components. Table 1 shows the given stages of growth for watermelon hybrids cultivated on open field. All varieties in 2005 showed differences in the sprouting date. Romanza F_1

sprouted two days later, Bambolino F_1 one day later, and Scherezade 4 days earlier than the standard variety Crimson Sweet.

Tab. 1. Stages of growth
Faze rasta

Godina Year	Variety *Sorta*	Date of sowing *Datum sijanja*	Date of sprouting *Datum klijanja*	Date of first harvest *Datum prve berbe*	Vegetation from sprouting to first harvest *Period vegetacije od klijanja do prve berbe*
2005	Crimson Sweet	May 25	June 9	August 19	72
	Romanza F_1	May 25	June 11	August 12	64
	Bambolino F_1	May 25	June 10	August 12.	63
	Bonta F_1	May 25	June 9	August 09	62
	Scherezada	May 25	June 5	August 03	60
2006	Crimson Sweet	April 27	May 5	August 18	104
	Pauline F1	April 27	May 5	August 11	97
	Nelson F1	April 27	May 5	August 18	104
	Joker F_1	April 27	May 5	August 09	95
	Carmen F_1	April 27	May 5	August 12	98
2007	Crimson Sweet	April 17	30.05	August 3	63
	Lady F_1	April 17	04.06	August 3	60
	Trophy F_1	April 17	01.06	August 2	62
	Fletta F_1	April 17	30.05	August 2	63
	Marabella F_1	April 17	31.05	August 3	63
	Super Crimson Sweet OP	April 17	01.06	August 6	67
	Fantasy F_1	April 17	01.06	August 1	62
2008	Crimson Sweet	April 13	April 22	July 2	90
	Crimson Ruby F_1	Apri13	April 22	July 18	87
	Biblos F1	April 13	April 22	July 21	90
	Pegasus F1	April 13	April 22	July 20	89
	Megan F1	April 13	April 22	July 12	81
2009	Crimson Sweet	April 16.	April 25	August 9	106
	Colosseo F_1	April 16.	April 25	August 8	105
	Caravan F_1	April 16.	April 25	August 9	106
	Montana F_1	April 16.	April 25	August 7	104

The hybrid Bonta F1 had the same date of sprouting with the standard variety. Compared to the standard variety, there was a significant difference in the date of the

first harvest. All of the examined watermelon hybrids were earlier than the Crimson Sweet (72).

Tab. 2. Average yield t/ha
Prosječan prinos t/ha

Year *Godina*	Variety *Sorta*	Average yield *Prosječan prinos*	+ - from/ *od ø*	CV	LSD	
					0.05	0.01
2005	Crimson Sweet	31.42	ø	7.05	3.04	4.19
	Romanza F_1	41,26	9.84	2.96		
	Bambolino F_1	59.7	28.28	4.91		
	Bonta F_1	40.72	9.3	7.08		
	Scherezada	41.1	9.68	5.23		
2006	Crimson Sweet	46.3	ø	13.41	9.46	13.26
	Pauline F1	54.6	8.3	15.98		
	Nelson F1	65.8	19.5	7.05		
	Joker F_1	44.3	-2.0	5.79		
	Carmen F_1	50.2	3.9	7.08		
2007	Crimson Sweet	59.3	ø	3.5	5.0	6.8
	Lady F_1	74.1	14.8	6.1		
	Trophy F_1	66.5	7.2	5.7		
	Fletta F_1	68	8.7	5.6		
	Marabella F_1	71.1	11.8	6.0		
	Super Crimson Sweet OP	77.7	18.4	6.6		
	Fantasy F_1	77.3	18	3.5		
2008	Crimson Sweet	36.8	ø	3.80	5.34	5.67
	Crimson Ruby F_1	42.7	5.9	5.93		
	Biblos F1	39.6	2.8	2.15		
	Pegasus F1	39.3	2.5	5.55		
	Megan F1	32.5	-4,3	3.96		
2009	Crimson Sweet	62.2	ø	2.25	3.26	4.94
	Colosseo F_1	64,1	2.0	1.60		
	Caravan F_1	61.4	-0.7	4.78		
	Montana F_1	67.5	5.4	4.30		

Hybrid Scherezada gave a 10 day earlier vegetation period than the standard variety. During the examination in 2006, the varieties Pauline F1 (7 days), Joker F_1 (9 days) and Carmen F_1 (6 days) were earlier than the standard Crimson Sweet (18 days). Only Nelson F1 had the same parameters for this trait (18 days) with the standard variety. The results suggest that the hybrid Joker F1 (104 days) had identical vegetation period with the standard Crimson Sweet (104 days). The incurred research made in 2007 showed that there was a difference in all analyzed parameters. Among all investigated hybrids, compared with the standard - sprouting came later, only hybrid

Flleta F1 showed same date of sprouting. Super Crimson Sweet OP had higher vegetation (67 days) compared with the standard Crimson Sweet (63 days). In 2008, the varieties Crimson Ruby F_1, Pegasus F1 and Megan F1 were earlier than the standard for 3.1 and 9 days respectively, but the variety Biblos F1 had the same days of vegetation as the standard (90 days). In 2009 all varieties had more or less the same vegetation.

The table 2 shows the average yields of the examined varieties over the five years (2005-2009). In 2005, all investigated varieties gave significant higher yields than the standard variety. In 2006 only the variety Nelson F1 had significant higher yield for about 19 t in comparison with the standard variety (46.3t/ha). In 2007 all investigated varieties, among which Lady F1, Trophy F_1, Fletta F_1, Marabella F_1 Super Crimson Sweet OP, Fantasy F_1 had significantly higher yield, particularly, the Super Crimson Sweet OP (77.7 t/ha) and Fantasy F_1 (77.3 t/ha) in comparison to the standard variety (59.3 t/ha). In 2008 only the variety Crimson Ruby F_1 was more yielded than the standard for about 5.9 t. The variety Montana F1 gave the highest yield (6.5 t/ha) with significance on level 0.01 in 2009.

Data in table 3 shows the characteristic of fruit. In 2005 the variety AC 20 F_1 gave the biggest average mass of the fruit (6.1kg) - which is in relation to the total yield. This hybrid and Romanza F_1 had the thinnest rind (13 mm). The fruit utilization (60.6) and the percentage of sugars (12 %) was biggest in the variety Bonta F_1. In 2006 the variety Nelson F1 had the biggest mass of the fruit (6.2) and thickness of the rind (14.8 mm). Carmen F_1 had the highest fruit utilization (58.3%) and thinnest rind (12.1 mm).

Joker F_1 showed the highest percentage of sugars (10.2 %). In 2007. the variety Marabella F_1 gave the largest fruit and the smallest percentage of fruit utilization (40.28 %). In 2008 Pegasus F1 gave the biggest mass of the fruit (4.8) and the highest percentage of fruit utilization (61 %). Crimson Ruby F_1 had the highest percentage of sugars (12.3%).

In 2009 all examined varieties showed lower mass of the fruit and lower percentage of fruit utilization. while bigger percentage of sugars in comparison to standard.

Conclusion

In accordance to the obtained results in the five year examination of 21 varieties of watermelon. these conclusions can be noted:

- The earliest varieties were: Montana F_1. Joker F_1, Lady F_1, Megan F1. Bonta F_1;
- The highest yield with statistical significance was recorded in these varieties: Bambolino F_1;
- Nelson F1. Super Crimson Sweet OP. Crimson Ruby F_1. Montana F_1;
- The biggest mass of the fruit was given by: Bambolino F_1. Nelson F1. Marabella F_1. Pegasus F1;

- All examined varieties showed stable traits and all are registered in the National Variety List of the Republic of Macedonia.

Tab. 3. Characteristics of fruit
Karakteristike ploda

Year *Godina*	Variety *Sorta*	Mass (kg) *Masa (kg)*	Index of fruit *Indeks ploda*	Thickness of rind *Debljina kore* (mm)	Fruit utilization % *Iskorišćenost ploda*	% of sugars *% šećera*	Colour of the flesh *Boja ploda*	Consistency *Konzistencija*	Sweetness of the flesh- *Slatkoća mesa*	Juicy of the flesh *Sočnost mesa*
2005	Crimson Sweet	4.9	1.11	15	61.2	8.5	red *crvena*	grainy *zrnasta*	3	3
	Romanza F_1	4.1	1.04	13	58.4	9.0	red *crvena*	grainy *zrnasta*	3	3
	Bambolino F_1	6.1	1.31	13	47.5	11.0	red *crvena*	fibrous *vlaknasta*	2	2
	Bonta F_1	5.0	1.42	15	60.6	12.0	red *crvena*	fibrous *vlaknasta*	3	2
	Scherezada	4.4	1.33	16	49.1	8.7	light red *svijeto crvena*	grainy *zrnasta*	3	3
2006	Crimson Sweet	5.3	1.06	14.1	54.4	8.9	red *crvena*	grainy *zrnasta*	3	2
	Pauline F1	5.7	1.14	14.2	53.8	9.1	red *crvena*	grainy *zrnasta*	3	3
	Nelson F1	6.2	1.63	14.8	47.1	8.4	red *crvena*	grainy *zrnasta*	3	3
	Joker F_1	4.2	1.04	13.4	48.3	10.2	red *crvena*	fibrous *vlaknasta*	3	3
	Carmen F_1	5.2	1.11	12.1	58.3	9.6	red *crvena*	fibrous *vlaknasta*	3	2
2007	Crimson Sweet	4.80	1.20	13	50.00	9.6	light red *svijet. crvena*	fibrous *vlaknasta*	2	2
	Lady F_1	6.27	1.42	11	51.04	9.2	light red *svijet. crvena*	grainy *zrnasta*	2	3
	Trophy F_1	5.22	1.17	9	43.16	10.8	red *crvena*	grainy *zrnasta*	3	3
	Fletta F_1	5.70	1.50	12	50.27	10.6	red *crvena*	grainy *zrnasta*	3	3

Tab. 3. Characteristics of fruit (continued)
Karakteristike ploda (nastavak)

Year *Godina*	Variety *Sorta*	Mass (kg) *Masa (kg)*	Index of fruit *Indeks ploda*	Thickness of rind *Debljina kore (mm)*	Fruit utilization % *Iskorišćenost ploda*	% of sugars *% šećera*	Colour of the flesh *Boja ploda*	Consistency *Konzistencija*	Sweetness of the flesh- *Slatkoća mesa*	Juicy of the flesh *Sočnost mesa*
2007	Marabella F_1	7.05	1.22	15	40.28	9.9	pink-light red *ružič. svijet. crvena*	fibrous *vlaknasta*	2	2
	Super Crimson Sweet OP	5.55	1.18	13	41.08	11.2	red *crvena*	grainy *zrnasta*	3	3
	Fantasy F_1	5.78	1.45	15	52.08	10.5	red *crvena*	grainy *zrnasta*	3	3
2008	Crimson Sweet	4.0	-	10	55	9.2	pink-red *ruž. crvena*	grainy *zrnasta*	3	3
	Crimson Ruby F_1	3.6	-	12	55	12.3	red *crvena*	grainy *zrnasta*	3	3
	Biblos F1	4.2	-	10	60	10.3	pink-red *ruž. crvena*	grainy *zrnasta*	3	3
	Pegasus F1	4.8	-	10	61	10.0	red *crvena*	grainy *zrnasta*	3	3
	Megan F1	2.1	-	7	58	10.0	red *crvena*	grainy *zrnasta*	3	3
2009	Crimson Sweet	5.8	-	10.2	37.9	7.0	red *crvena*	grainy-fibrous *zrnastovlaknasta*	3	3
	Colosseo F_1	5.1	-	10.0	30.7	8.4	red *crvena*	grainy *zrnasta*	3	3
	Caravan F_1	4.1	-	7.9	25.6	8.1	red *crvena*	grainy *zrnasta*	3	3
	Montana F_1	5.2	-	10.8	25.2	9.9	red *crvena*	grainy *zrnasta*	3	3

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Poređenje nekoliko hibrida lubenice (C*itrullus lanatus* Thunb.) u Republici Makedoniji

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Sažetak

Lubenica se tradicionalno uzgaja u Republici Makedoniji. Veliki broj varijeteta i hibrida su registrovani na Nacionalnoj listi varijeteta. Prije nego što se uvedu u komercionalnu proizvodnju svi strani hibridi i novostvoreni varijeteti se ispituju da bi se ustanovile faze razvoja, prinos i karakteristike ploda. Ogled je postavljen na oglednim parcelama Instituta za poljoprivredu u Skoplju. U periodi od 2005-2009. godine 21 varijetet i hibrid lubenice je ispitivan, a to su: Romanza F_1, Bambolino F_1, Bonta F_1 i Scherezada u 2005. godini; Pauline F1, Nelson F1, Joker F_1 i Carmen F_1 u 2006. godini; Lady F_1, Trophy F_1, Fletta F_1, Marabella F_1, Super Crimson Sweet OP i Fantasy F_1 u 2007. godini; Crimson Ruby F_1, Biblos F1, Pegasus F1 i Megan F1 u 2008.godini; Colosseo F_1, Caravan F_1 i Montana F_1 u 2009. godini. Crimson Sweet je uzet kao standardni varijetet. 2005. godine Bambolino F1 je dao veći prinos (59,7t/ha) od standardnog varijeteta (31,42t/ha). 2006. godine Nelson F1 istakao se sa značajno većim prinosom od 65,8 t/ha u poređenju sa standardnim varijetetom kod koga je to iznosilo 46,3 t/ha. 2007. godine svi ispitivani varijeteti su dali bolje rezultate od standardnog varijeteta. 2008. godine Crimson Ruby F_1 imao je veći prinos (42,7 t/ha) od standardnog varijeteta (36,8t/ha). 2009. godine Montana F_1 je takođe bila uspješnija sa prinosom (67,5 t/ha) od standardnog varijeteta (62,2 t/ha). Svi ispitivani varijeteti i hibridi imali su stabilne karakteristike i registrovani su na Nacionalnoj listi varijeteta za komercionalnu proizvodnju.

Ključne riječi: lubenica, hibridi, prinos

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