COMPARISON OF DIFFERENT MULCH MATERIALS ON SOME TOMATO (*Solanum lycopersicum*) CULTIVARS UNDER CONTROLLED ENVIRONMENT CONDITIONS

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Abstract: *Tomato production, in protected areas, is one of the most effective ways of human activity in agriculture, taking into account financial investments and technology he applies. Tomato hybrids under study were Amati and Big-beef, whereas investigation was undertaken in three variants (with black plasmas, white plasmas and without plasmas). During our investigation we have monitored and analyzed the following indicators: biometric indicators of plant and fruits,indicators of earliness of variants, dynamic of production in sun greenhouses in the region of Anadrini, Kosovo. Planting distance was 100 x 40 cm with crop density of 2.5 crops/m2. Experimental design was complete randomized block system in three replicate for each of the variants. During the experiment with a great care were recorded phenological data and biometric measurements. The highest tomato yield for the Amati hybrid was recorded at the variant using black plastic mulch (285.44), while the lowest at the variant that did not use plastic (249.96). The yield for the Amati hybrid in the variant using white plastic was 256.34. The H-D ratio indicator values are between 0.85 – 0.80, which means that the shape of the fruit is rounded and slightly flattened. The values in relation to the thickness of the epicarp are in the range of 0.40 – 0.35 mm; it seems that differences between the hybrids are visible. As for the earliness of production of variants in production, with regard to hybrid Amati the first variant (black plasmas) showed the highest earliness compared to other variants. With regard to the mulching in sun glasshouse the best variant showed to be the variant with black plasmas, for both of hybrids in study, Amati and Big-Beef (1998 respectively 2156 kv/ha). Beside this the black plasmas has also the effect on suppressing the growth of weeds. Both of hybrids, Amati, Big-Beef showed to have earliness production, high quality fruits and high yield.*

Key words: *Tomato, earliness indicator, dynamic of production*

INTRODUCTION

Tomato production, in protected areas, is one of the most effective ways of human activity in agriculture, taking into account financial investments and technology he applies. Protected areas also enhance the fast growth of tomato crop, utilization of his production genetic capacity through application of good agricultural practices, with the aim of optimization of soil and climate indicators with the natural and biological requirements of the tomato crop. Tomato production in protected areas has a lot of difficulties, for resolving of which is more than necessary to undertake a range of studies oriented towards evaluation of some efficacy indicators of production in protected areas compared to those in open fields, improvement of the production technologies and marketing, (BALLIU, 1999).

Through application of the new tomato production technologies in protected environment like: micro clime control, ridges, mulching in glasshouse, use of crystalline fertilizers, drip irrigation, adequate plant protection measures against pathogens and pest, etc. , will make the use of production capacities of tomatoes in more effective manner.

Tomato is one of the vegetables that is characterized by his high plasticity to be used in different manners and conditions and that for this the demand for this crop is increasing rapidly. The area cultivated under this crop are becoming more and more each year in Kosovo, both in open fields and protected areas as well.

In Kosovo, this is the first study with regard to the impact of mulching in earliness and in the yield of some tomato hybrids under protected areas.

MATERIAL AND METHODS

Two tomato hybrids (Amati and Big Beef) of Netherlands origin were planted in sun glasshouse in the region of Anadrini, Rahovec. For our investigation in this study was taken the impact of mulching in tomato yield of hybrids (Amati and Big-Beef) in three variants (black plasmas, white plasmas and without plasmas as a control group). The seeds were sown in plastic modules filled with industrial peat. The ready seedlings were planted is glasshouse on 6/03, 26/03, 06/04 and 16/04 with regard on the years of investigations (2007- 2009).

Planting distance was 100 x 40 cm with crop density of 2.5 crops/m2. Experimental design was complete randomized block system in three replicate for each of the variants. During the experiment with a great care were recorded phenological data and biometric measurements. The fruits were harvested and weighted from each of the variants in experiment according to the period of time defined by experiment. The yield data were converted in kv/ha and were used for further work (figure 1).

During these investigations were observed and analyses the following indicators:Phenological data (date of seed sowing, date of germination, plating of seedlings in sun glasshouse, date of flowering, date of fruit set, percentage of fruit set, date of fruit maturity), Biometric indicators of crop and fruits, opening flowers and fruit set, earliness indicator of hybrids, yield according to the harvested dates (kv/ha) and dynamic of production (kv/ha)

Figure 1. Tomato hybrids during the cropping season and tomato harvested ready for market

RESULTS AND DISCUSSION

Considering results of three years of research (2008-2010) of cultivation of two Dutch varieties of tomatoes (Amati and Big-Beef) in greenhouse conditions in village Radoste of the Anadrini region, it is determined that the yield of such cultivation is very high.

Table 1 shows different indicators of the fruit including the H-D ratio related to the shape of the fruit. The H-D ratio indicator values are between 0.85 – 0.80, which means that

the shape of the fruit is rounded and slightly flattened. The values in relation to the thickness of the epicarp are in the range of 0.40 – 0.35 mm; it seems that differences between the hybrids are visible. Differences in number of chambers are small. The number of chambers for the two hybrids studied range between 5.0 and 5.5; it is identified a positive relation between the number of chambers and the average weight of the fruits. In terms of fruit weight a difference is observed between the hybrids. The Amati hybrid the average fruit weight is 205,40 grams, while for Big Beef it is 229,70 grams.

Table 1.

Biometric indicators of tomato fruits

N_0.	Hybrids	Ratio H/D	Epicarp width (mm)	Number of fruit chambers	Average weight of fruits (gr)
1.	Amati	0.85	0.40	5	205.40
2.	Big-Beef	0.80	0.35	5.5	229.70

In table 2 the height of the plants, measured after cutting the tip, ranges between 198.75 cm (Big-Beef) and 200.5 cm (Amati). The height of the first level ranges between 22.5 and 24.5 cm, corresponding to Amati and Big-Beef hybrids. The height between the third level and the fourth level ranges between 20.6 and 19.2 cm, corresponding to the Amati and Big-Beef hybrids. Stalk thickness ranges between 1.40 and 1.45 cm, corresponding to the Amati and Big-Beef hybrids.

Table 2.

Biometric indicators of the crop

No.	Hybrids	Crop height (cm)	Height of I floor from soil (cm)	Distance between floors III-IV (cm)	Stem width (cm)
1.	Amati	200.5	22.50	20.6	1.40
2.	Big-Beef	198.75	24.50	19.2	1.45

Table 3 shows that there are differences in yields for the Amati hybrid depending on the planting time, variant/plastic used and the year of research. The highest yield was recorded in the second term of the planting time (276.80 kv/ha), while the lowest yield was recorded in the fourth term of planting (247.87 kv/ha). While in the first and third terms the yields recorded were 271.54 and 259.44 kv/ha respectively.

In support of the variance analysis and LSD test, there were not recorded any significant statistical differences between the planting times in the yields for the Amati hybrid and we can determine that the recorded differences have been occasional.

Significant statistical differences of different levels were recorded between the variants in the research (Factor B). The highest tomato yield for the Amati hybrid was recorded at the variant using black plastic mulch (285.44), while the lowest at the variant that did not use plastic (249.96). The yield for the Amati hybrid in the variant using white plastic was 256.34.

Table 4 related to the Big-Beef tomato hybrid shows that differences in yield were recorded depending on the planting time, variant/plastic use and year of research. The highest yield was recorded in the first term of the planting time (291.52 kv/ha), while the lowest yield was recorded in the fourth term of planting (259.75 kv/ha). While in the second and third terms the yields recorded were 288.85 and 285.67 kv/ha respectively.

In support of the variance analysis and LSD test, there were not recorded any significant statistical differences between the planting times in the yields for the Big-Beef hybrid and we can determine that the recorded differences have been occasional.

Significant statistical differences of different levels were recorded between the variants in the research (Factor B). The highest tomato yield for the Big-Beef hybrid was recorded at the variant using black plastic mulch (307.98), while the lowest at the variant that did not use plastic (267.37). The yield for the Big-Beef hybrid in the variant using white plastic

was 268.99.

Table 3.

Amati, yield kv/ha, (ANOVA)

Time (A)	Variant (B)	Year (C)			Average (AxB)	Average (A)
		2008	2009	2010		
I	Black plasmas	304.14	,257.26	,334.40	298.60 **	271.54 Ns
	White plasmas	265.41	234.54	282.19	260.71 Ns	
	Without plasmas	270.38	,218.57,	277.00	255.32 Ns	
	Average (AC)	279.98	236.79	297.86		
II	Black plasmas	303.31	246.80	317.69	289.27 *	276.80 Ns
	White plasmas	276.56	245.85	293.33	271.91	
	Without plasmas	275.72	235.21	296.75	269.23	
	Average (AC)	285.20	242.62	302.59 **		
III	Black plasmas	314.79	211.14	334.64	286.86	259.44 Ns
	White plasmas	277.14	209.04	273.16	253.11	
	Without plasmas	247.85	200.27	266.94	238.35	
	Average (AC)	279.93	206.82	291.58		
IV	Black plasmas	272.09	220.96	308.00	267.02	247.87 Ns
	White plasmas	252.29	206.18	260.44	239.64 *	
	Without plasmas	303.89	183.86	223.14	236.96 **	
	Average (AC)	276.09	203.67 **	263.86		
		C1	C2	C3	Average (B)	
Average (BxC)	Black plasmas	298.58	234.04	323.69 **	285.44 **	
	White plasmas	267.85	223.90	277.28	256.34 Ns	
	Without plasmas	274.46	209.48 **	265.96	249.96 **	
Average (C)		280.30	222.47 **	288.97 **	Interaction (A xB x C) **	

FACTORS		A	B	C	AB	AC	BC	ABC
LSD	1 %	103.684	27.304	33.580	59.922	73.694	62.288	157.759
	5 %	78.768	20.743	25.510	44.026	54.144	46.169	106.630

Table 4.

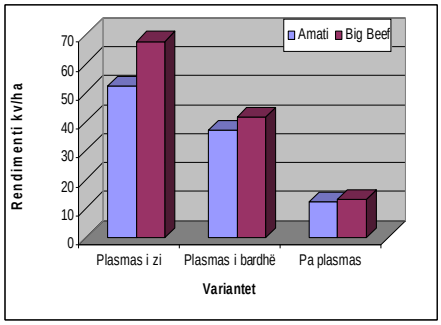
Big-Beef, yield kv/ha, (ANOVA)

Time (A)	Variant (B)	Year (C)			Average (AxB)	Average (A)
		2008	2009	2010		
I	Black plasmas	354.04	231.18	389.61	324.94 **	291.52 Ns
	White plasmas	293.59	207.89	327.04	276.17	
	Without plasmas	272.96	225.26	322.07	273.43	
	Average (AC)	306.86	221.44 **	346.24 **		
II	Black plasmas	335.18	245.32	338.46	306.32	288.85 Ns
	White plasmas	289.07	248.25	274.29	270.54	
	Without plasmas	298.21	256.36	314.54	289.70	
	Average (AC)	307.49	249.98	309.09		
III	Black plasmas	329.89	267.50	337.79	311.73	285.67 Ns
	White plasmas	306.36	237.79	293.71	279.29	
	Without plasmas	263.39	227.89	306.71	266.00	
	Average (AC)	299.88	244.39	312.74		
IV	Black plasmas	309.57	245.46	311.71	288.92	259.75 Ns
	White plasmas	254.86	241.96	254.14	249.99	
	Without plasmas	243.18	237.82	240.05	240.35 **	
	Average (AC)	269.20	241.75	268.30		
		C1	C2	C3	Average (B)	
Average (BxC)	Black plasmas	332.17	247.37	344.39 **	307.98 **	
	White plasmas	285.97	233.97 **	287.05	268.99 *	
	Without plasmas	269.44	236.83	295.84	267.37 **	
Average (C)		295.86 Ns	239.39 **	309.09 **	Interaction (A xB x C) **	

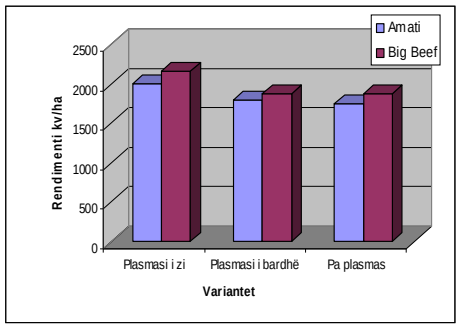
FACTORS		A	B	C	AB	AC	BC	ABC
LSD	1 %	96.794	29.804	31.291	65.408	68.669	58.041	147.004
	5 %	73.533	22.642	23.771	48.057	50.453	43.021	99.361

Graph 1 shows the earliness of production according to the variants in kv/harvesting time. It is recorded that the Big-Beef hybrid cultivated in black plastic mulch has earlier

production with a yield of 67.82 kv/ha in the first period. Also the Amati hybrid cultivated in black plastic mulch has given a high yield (52.49 kv/ha in the first period). In the variant without plastic both hybrids Amati and Big-Beef have given the lowest yields with 12.29 and 13.05 kv/ha respectively. This analysis is important in order to evaluate the influence of the hybrids in the periods with highest prices in the market.



Graph 1. Earliness of production by variants



Graph 2. Yield (Kv/ha), by hybrids and variants

In graph 2 the production dynamic is presented. In this graph we can observe that the highest general yield for both the hybrids included in the research is recorded in the first variant, with black plastic mulch with 1998 kv/ha for Amati and 2156 kv/ha for Big-Beef, then other variants follow.

CONCLUSIONS

As for the earliness indicator according to variants, kv/period of harvested, it was shown that hybrid Big-Beef cultivated with black plasmas has highest earliness with an yield of 67.82 kv/ha/firs period. The hybrid Amati cultivated under black plasmas gave highest yield of 52.49 kv/ha/first period, as well. With regard to control (without plasmas) both of hybrids (Amati and Big-Beef), gave the lowest yield 12.29 respectively 13.05 Kv/for the first period.

With regard to the mulching in sun glasshouse the best variant showed to be the variant with black plasmas, for both of hybrids in study, Amati and Big-Beef (1998 respectively 2156 kv/ha). Beside this the black plasmas has also the effect on suppressing the growth of weeds.

Both of hybrids, Amati, Big-Beef showed to have earliness production, high quality fruits and high yield.

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