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CHARACTERIZATION AND INTRODUCTION OF NEW TOMATO HYBRIDS

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Abstract

The determination of the organoleptic characteristics in tomato *Lycopersicon esculentum* Mill. is a significant part in the basic needs and requirements of the market, but also in increasing the export potential. The aim of the research is the selection of new red tomato hybrids *Lycopersicon esculentum* Mill. According to their organoleptic, morphological and sensory characteristics, for possible commercialization. In the research, 23 coded new indeterminate hybrids of red tomato were analysed and compared with 5 already present commercial hybrids (Brave F1, Adriatik F1, Matissimo F1, Alamina RZ F1, Signora F1). The tomato was produced from seedlings by a registered nursery grower Agro Koni, and it was planted in sheltered areas at a grower in Tirana, Albania. The properties that were examined: tomato earliness (1 late / 5 early), plant strength (1 weak / 5 strong), internodes length (1 long / 5 short), fruit quality (1 bad / 5 excellent), fruit size (1 small/ 5 large), as well as fruit color, fertility potential (yield), as well as overall evaluation of the plants in a rank from 1 (bad) to 5 (excellent). The relationships between analysed properties, descriptive and the variance's analysis provided an insight into those hybrids that satisfy the methodological requirements. Based on the results and determination of new hybrids with improved properties from the existing ones, the needs of the market and consumers are influenced. According to the genetic potential and phenotypic characteristics, 3 new hybrids (TME221276, TME220244 and TME220245) were determined, which satisfied the examined criteria, thus giving the opportunity to be included in the cluster of commercial hybrids on the market.

Key words: *tomato, indeterminate hybrids, sensory analysis*

INTRODUCTION

Tomato (*Lycopersicon esculentum* L.), globally, is the most consumed vegetable. The fruit shape is an important agronomic trait that affects fruit quality and economic value (Azzi et al. 2015). Tomato is considered as a model plant for fruit shape study (Bergougnoux, 2014). Globally, more than 5 million ha of tomatoes have been cultivated (Argento et al. 2019), with an average yield of 35.9 t/ha and an annual production of more than 180 million tons, according to FAOSTAT (FAO, 2020). Tomatoes contain many nutrients, such as vitamin A, vitamin B, vitamin C, magnesium, potassium, sodium, iron, flavonoids, and lycopene (Oboulbiga et al. 2017; Mubarok et al. 2019). Choosing of adaptive plant variety (Macholdt and Honermejer. 2016; van Etten et al.2019) can be the recommended practice to overcome the occurrence of drought stress in the agro-ecosystem. The genotypes (cultivars), plant growing conditions (ecological and technological), the time of fruit harvest, physiological and biochemical changes that fruits undergo after harvest, as well as many other different factors, decisively influence the fruit quality, understood as a complex concept, which includes all agronomic, commercial, nutritional,

and gustatory components of fruits. (Felföldi et al. 2021, Bădulescu, et al. 2020). In tomato production, use tomato hybrids give better characteristics on fruit, such as high productivity, early maturity, high fruit uniformity, high fruit quality, and disease resistance. According to Atanassova & Georgiev (2007), tomato hybrid production often produces plants with desirable characteristics superior to the native plants, but at the same time, the production of hybrid seeds is generally not easy and laborious.

MATERIAL AND METHODS

In our research, 23 indeterminate red tomato hybrids were examined compared to 5 tomato hybrids that exist on the market. Tomato is produced from seedlings in a specialized company for the production of seedlings Agro Koni - Tirana in R. Albania. The produced seedlings are planted in protected areas by an individual producer in the Republic of Albania. The sensory analyses of the samples are rated from 1 to 5. The characteristics of tomato type were examined, of which 1 late / 5 early, plant strength 1 weak / 5 strong, length of internodes 1 long / 5 short, fruit quality 1 bad / 5 excellent, fruit size 1 small / 5 large, fruit colour, fertility potential (yield) and overall rating of the plants are determined in a rank from 1(poor) to 5 (excellent).

Comparative studies have been made between introduced hybrids and the hybrids Brave F1, Adriatik F1, Matissimo F1, Alamina RZ F1, Signora F1, which are presented on the market.

The analysis of the obtained data was done by determining the mean values and the error of the mean values, as well as determining the correlation coefficient, according to Pearson, between the new and the old hybrids.

RESULTS AND DISCUSSION

The analysis of the obtained data first started with the determination of the mean values and the error of the mean values, the correlation or ratio between the new and old hybrids presented over the control, determining the trends of the tested properties and determining the significant new hybrids in a relation to the control.

Firstly, the comparison of mean values showed higher values than the control in hybrids TME 222776 and TME 220244. The new hybrids TME220245 and TME221285 are within the limits of the values determined by the hybrids constituting the control. Whereas, the hybrids TME 219211, TME221277 and TME221288 can be compared with the low values obtained from the control. (Figure 1).

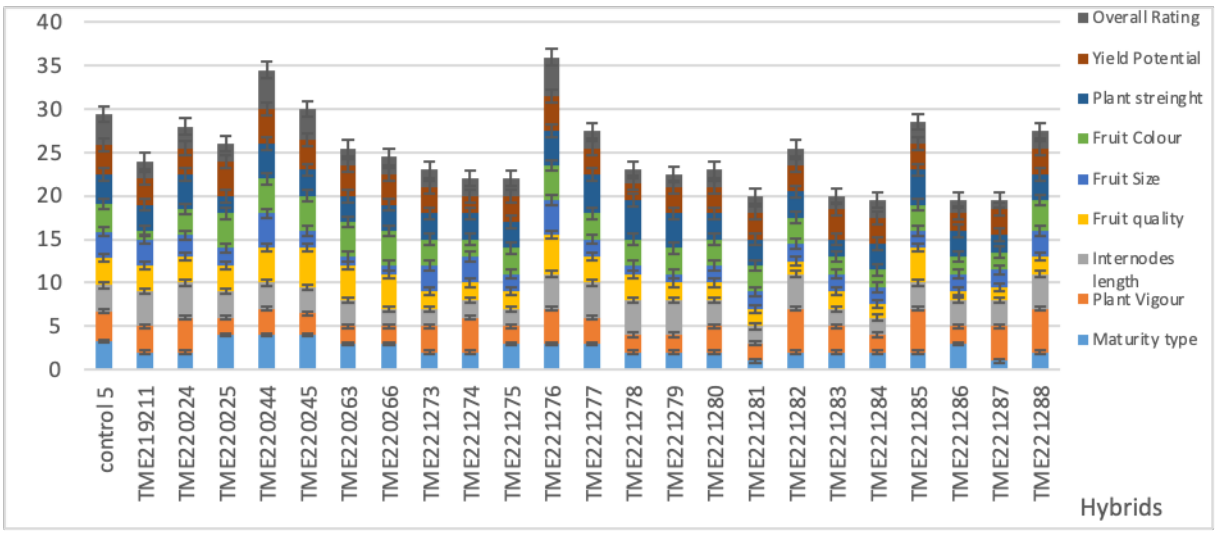

Figure 1. Comparison of the control with the new hybrids through the errors of the mean.

The relationships between the determined values from the control and compared hybrids showed a weak positive and negative correlation. A weak correlation was found between the control and TME 220244, TME22245, TME220266, TME221275, TME221283, TME221284 and TME221285, also a negative weak correlation was found between the control and TME219211. Obtained data has shown a strong correlation between the hybrids TME220266 and TME 220263, TME 221277 with TME221278 and TME221279, and also between TME 221278 with TME221279 and TME 221287 with TME 221288 (Table 1).

Table 1. Correlation between control and new 23 indeterminate hybrids.

	control Ø 5	TME219211	TME220224	TME220225	TME220244	TME220245	TME220263	TME220266	TME221273	TME221274	TME221275	TME221276	TME221277	TME221278	TME221279	TME221280	TME221281	TME221282	TME221283	TME221284	TME221285	TME221286	TME221287	TME221288
Cont5	1																							
TME219211	-0.32	1.00																						
TME220224	-0.02	0.55	1.00																					
TME220225	-0.10	-0.36	-0.34	1.00																				
TME220244	0.35	-0.58	-0.70	0.09	1.00																			
TME220245	0.22	-0.46	-0.34	0.65	0.40	1.00																		
TME220263	0.07	-0.22	0.11	0.72	0.06	0.83	1.00																	
TME220266	0.25	-0.40	-0.04	0.68	0.26	0.85	0.95	1.00																
ME221273	0.09	-0.09	0.30	-0.11	-0.08	-0.50	-0.16	-0.03	1.00															
TME221274	0.13	0.26	0.48	-0.66	-0.46	-0.73	-0.57	-0.48	0.58	1.00														
TME221275	0.31	-0.46	-0.14	0.62	0.32	0.35	0.51	0.60	0.35	-0.25	1.00													
TME221276	0.08	0.17	0.29	-0.47	0.14	0.00	0.00	0.00	0.00	0.00	-0.55	1.00												
TME221277	-0.03	0.39	0.72	0.09	-0.44	0.07	0.48	0.32	0.07	0.06	0.38	-0.18	1.00											
TME221278	-0.11	0.27	0.68	0.06	-0.31	0.22	0.58	0.41	-0.06	-0.11	0.26	0.06	0.93	1.00										
TME221279	-0.03	0.27	0.68	0.25	-0.35	0.11	0.56	0.37	0.11	-0.16	0.45	-0.07	0.91	0.89	1.00									
TME221280	0.09	0.18	0.78	0.14	-0.55	-0.20	0.32	0.20	0.55	0.25	0.35	0.00	0.65	0.56	0.78	1.00								
TME221281	0.17	-0.07	0.45	0.04	0.13	-0.04	0.34	0.37	0.67	0.03	0.40	0.43	0.32	0.39	0.53	0.67	1.00							
TME221282	0.06	0.32	0.78	-0.14	-0.84	-0.46	-0.08	-0.21	0.39	0.56	-0.07	-0.06	0.43	0.27	0.45	0.81	0.22	1.00						
TME221283	0.24	0.27	0.28	0.27	-0.37	-0.17	0.12	0.16	0.53	0.31	0.23	-0.12	0.10	-0.15	0.14	0.53	0.32	0.51	1.00					
TME221284	0.42	0.14	0.28	0.04	0.13	-0.24	0.06	0.10	0.55	0.11	0.63	-0.14	0.44	0.25	0.53	0.55	0.63	0.22	0.47	1.00				
TME221285	0.31	0.29	0.77	-0.31	-0.50	-0.04	0.22	0.23	0.28	0.57	-0.16	0.36	0.45	0.42	0.29	0.51	0.31	0.59	0.39	0.06	1.00			
TME221286	-0.15	0.20	0.26	0.13	-0.35	-0.28	-0.04	-0.19	0.06	0.08	0.45	-0.71	0.64	0.45	0.58	0.39	-0.09	0.36	-0.02	0.44	-0.18	1.00		
TME221287	-0.07	0.51	0.73	-0.11	-0.81	-0.51	-0.09	-0.19	0.51	0.57	-0.16	0.07	0.30	0.13	0.32	0.75	0.31	0.89	0.74	0.25	0.59	0.13	1.00	
TME221288	-0.16	0.31	0.74	-0.19	-0.84	-0.57	-0.17	-0.28	0.52	0.64	-0.17	0.00	0.30	0.18	0.32	0.75	0.26	0.95	0.48	0.10	0.54	0.25	0.91	1.00

*Correlation coefficient (r) (-1=1): 0.85 - 1 strong, 0.5 - 0.85 moderate, 0.1 - 0.5 weak, and 0.0 no correlation -Pearson correlation test.

The coefficient of determination (R^2) from the tested traits between the control and the new hybrids showed a linear upward trend in all new hybrids for the trait Plant vigour. A property- that is constant compared to the control is the length of internodes, and to some extent the potential of plants.

For the studied properties of quality, maturity and colour of the tomatoes in the new hybrids, we obtained a regression trend compared to the control. (Figure 2).

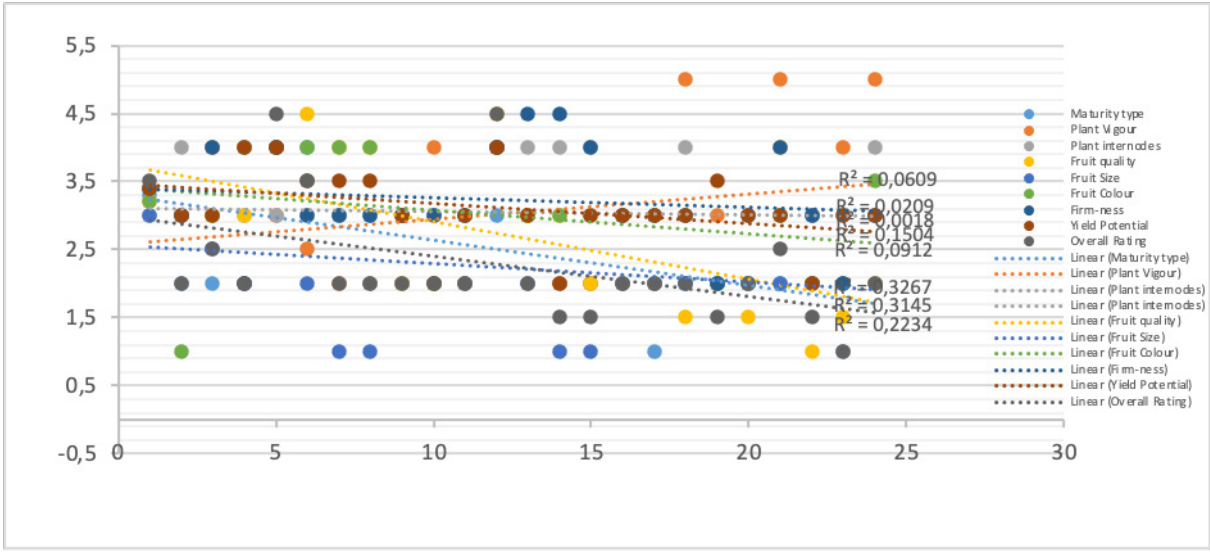

Figure 2. Trend between the tested properties of the control in comparison with the new hybrids.

Statistical analysis of data showed that the control had statistically significant differences at the LSD > 0.05 level only with the hybrid TME221276. Table 2.

Table 2. Identification of hybrids with the smallest differences in relation to the control.

	Control Ø 5	TME219211	TME220224	TME220225	TME220244	TME220245	TME220263	TME220266	TME221273	TME221274	TME221275	**TME221276**	TME221277	TME221278	TME221279	TME221280	TME221281	TME221282	TME221283	TME221284	TME221285	TME221286	TME221287	TME221288
Maturity type	3.3	2.0	2.0	4.0	4.0	4.0	3.0	3.0	2.0	2.0	3.0	3.0	3.0	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	3.0	1.0	2.0
Plant vigor	3.4	3.0	4.0	2.0	3.0	2.5	2.0	2.0	3.0	4.0	2.0	4.0	3.0	2.0	2.0	3.0	2.0	5.0	3.0	2.0	5.0	2.0	4.0	5.0
Plant internod.	3.0	4.0	4.0	3.0	3.0	3.0	3.0	2.0	2.0	2.0	2.0	4.0	4.0	4.0	4.0	3.0	2.0	4.0	2.0	2.0	3.0	3.0	3.0	4.0
Fruit quality	3.2	3.0	3.0	3.0	4.0	4.5	4.0	4.0	2.0	2.0	2.0	4.5	3.0	3.0	2.0	2.0	2.0	1.5	2.0	1.5	4.0	1.0	1.5	2.0
Fruit Size	3.0	3.0	2.5	2.0	4.0	2.0	1.0	1.0	3.0	3.0	2.0	4.0	2.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.0
Fruit Color	3.2	1.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	2.0	3.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0	2.0	2.0	3.0	2.0	2.0	3.5
Firm-ness	3.4	3.0	4.0	2.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0	4.0	4.5	4.5	4.0	3.0	3.0	3.0	2.0	3.0	4.0	3.0	2.0	3.0
Yield potential	3.4	3.0	3.0	4.0	4.0	3.5	3.5	3.5	3.0	2.0	3.0	4.0	3.0	2.0	3.0	3.0	3.0	3.0	3.5	3.0	3.0	2.0	3.0	3.0
Overall rating	3.5	2.0	2.5	2.0	4.5	3.5	2.0	2.0	2.0	2.0	2.0	4.5	2.0	1.5	1.5	2.0	2.0	2.0	1.5	2.0	2.5	1.5	1.0	2.0
Mean	3.3	2.7	3.1	2.9	3.8	3.3	2.8	2.7	2.6	2.4	2.4	4.0	3.1	2.6	2.5	2.6	2.2	2.8	2.2	2.2	3.2	2.2	2.2	3.1
LSD	0.68																							

**LSD test was determinate on level > 0.05*

CONCLUDING REMARKS

The success of tomato breeding is related to knowing the requirements of producers and consumers, but also of processors and growers. The hypothesis of this study was based on the creation of new commercial hybrids that could meet the needs of consumers and market chains, in terms of the overall quality of the tested genotypes. From the research so far and the obtained data on the quality characteristics of the new hybrids and the statistical processing of the data, it was found that the hybrids: TME221276 showed good qualities and sizes of fruits, good yield with round and smooth fruits, TME220244 gave fruits with good characteristics and good potential of the yield and TME220245 showed very good fruit quality, potential and good plant vigour. These quality characteristics and analyses of the three hybrids, do not give us the right to recommend that they could be included in the variety lists of tomato hybrids that will satisfy market and economic aspects.

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КАРАКТЕРИЗАЦИЈА И ИНТРОДУКЦИЈА НА НОВИ ХИБРИДИ ДОМАТИ

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Резиме

Одредувањето на органолептичките карактеристики на доматот *Lycopersicon esculentum* Mill. е значаен дел во задоволување на основните потреби и барања на пазарот, но и во зголемување на извозниот потенцијал. Целта на истражувањето е избор на нови хибриди домат *Lycopersicon esculentum* Mill. според нивните органолептички, морфолошки и сензорни карактеристики, за нивна комерцијализација. Во истражувањето беа анализирани 23 шифрирани нови индетерминантни хибриди на црвен домат кои беа споредени со 5 веќе присутни комерцијални хибриди (Brave F1, Adriatik F1, Matissimo F1, Alamina RZ F1, Signora F1). Домат беше произведен од расад од регистриран расадопроизводител Агро Кони, и истиот беше расаден во заштитени простори кај производител во Тирана, Р. Албаниа. Испитувани беа својствата: тип на домат (1 доцен / 5 ран) , јачина на растение (1 слабо /5 силно), должина на интернодии (1 долги/ 5 кратки), квалитет на плод (1 лош/ 5 одличен), големина на плод (1 мал/ 5 голем), како и боја на плодот, потенцијалот на родност (принос), како и севкупна оцена на растенијата во ранг од 1 (лоши) до 5 (одлични). Релациите помеѓу анализираните својства, описната и анализата на варијанса обезбеди увид на оние хибриди кои ги за задоволуваат методолошките барања. Врз основа на резултатите и утврдување на нови хибриди со подобрени својства од постоечките, се влијае на потребите на пазарот и потрошувачите. Согласно генетскиот потенцијал и фенотипските карактеристики се детерминираа 3 нови хибрида (TME221276, TME220244 и TME220245) кои ги задоволија испитуваните критериуми, со што се дава можност да бидат вклучени во кластерот на комерцијални хибриди на пазарот.

Клучни зборови: *домат, индетерминантни хибриди, сензорна анализа*