

Characterization of seasonal tomato varieties and study of their aptitude for processing in Tunisia

Introduction

The cultivation of industrial tomatoes occupies 15 to 18 thousand ha every year. During the campaign 2020, we processed 945 thousand tons of fresh tomatoes against 800 thousand tons in 2019. These quantities have allowed to produce 145 thousand tons of tomato paste in 2020 against 123 thousand tons of tomato paste in 2019; that is to say an industrial yield of about 6.5. The extension in terms of sowing for this crop, has shown its limit during the last decade where we experienced many problems related to the availability of irrigation water or saturation of processing units from the first week of July.

The regular monitoring of data from the industrial tomato processing campaigns, has detected a gradual deterioration of industrial yield from one campaign to another. The latter has gone from 5.75 kg of fresh tomatoes Tf to produce 1 kg of Double Concentrate DCT in 2009 to 6.92 in 2015 and 6.5 kg Tf / kg DCT for the period between 2016 and 2020. This represents an equivalent loss of earnings per campaign of at least 75 thousand tons of fresh tomatoes and an equivalent loss exceeding 14.6 million dinars (based on an annual production of 100 thousand tons of DCT and a reference price of 195 millimes / kg of fresh tomato). This deterioration of the industrial output is the result of the deterioration of the quality of fresh tomatoes received characterized by low contents in °Brix and high rates of waste (foreign bodies, green fruits and rotten tomatoes). This waste has a negative impact on the production costs involving additional economic charges (maintenance costs...). To remedy, it is essential to adopt a program of upgrading the agronomic link, which has targeted so far only the search for varieties ensuring high productivity per ha with the minimum costs while ignoring any potential varietal quality. An annual program of varietal trials of the seasonal tomato crop has been established to quantitatively and qualitatively characterize the productive potential of available tomato varieties and to evaluate their suitability for processing.

Purposes

- To study the real productive potential and quantitative and qualitative characterization of the different varieties of tomato of season available on our market.
- To study the suitability of tomato varieties for processing.
- To elaborate a database of the different criteria of productivity and quality of tomato varieties (to be updated every season).

Geographical location

Since 2016, and with the collaboration of processing units, nurseries and seed companies, the Tunisian Group for canned food Industries GICA has set up 38 experimental stations of tomato varieties, at the level of the main regions of the cultivation of seasonal tomato (CapBon, Kairouan, Gafsa and North West ...) to study the varieties available on the Tunisian market (Figure 1).

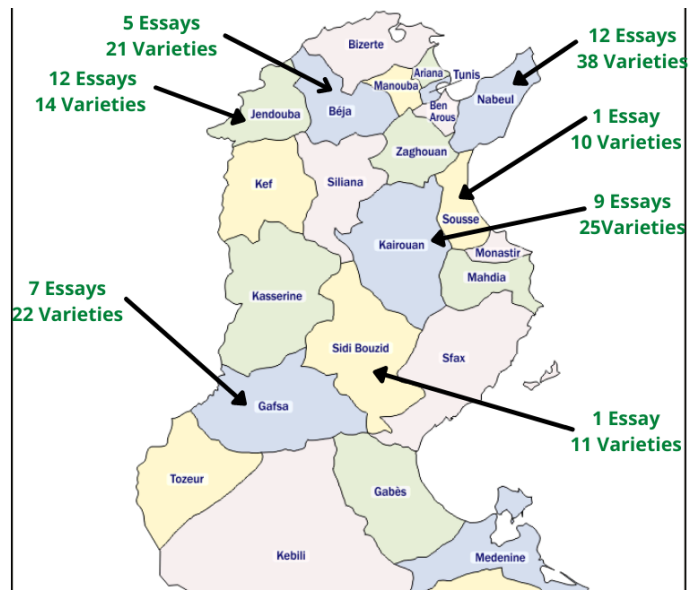


Figure 1: Map of trials locations.

Distribution of the trials

In order to evaluate the productive and qualitative potential of the varieties and their adaptations in the main areas of cultivation of seasonal tomato, we have set up our trial stations in different areas that differ by the earliness of the crop, the soil and climatic conditions and the salinity of the irrigation water (Table 1).

Before transplanting the seedlings, the varieties were coded and the same cultivation methods (irrigation, fertilization, phytosanitary treatments, etc.) were applied to all varieties in each site.

Table 1. Distribution of trials by season, crop region and irrigation water quality

Region		CapBon		Kairouan		Gafsa		Béja		Jendouba		Errakhet		Bouficha	
Number of overall trials		13		9		7		5		2		1		1	
Salinity of irrigation water		N*	E**	N	N	N	E	N	E	N	E	N	E	N	E
Number of trials		8	5	5	4	6	1	5	-	1	1	1	-	1	-
Number of varieties		32	28	23	15	22	8	21	-	9	7	11	-	10	-
Campaign	2016	1	-	-	-	-	-	1	-	-	-	-	-	-	-
	2017	1	1	1	2	1	-	1	-	-	-	-	-	-	-
	2018	2	1	1	-	1	1	-	-	-	1	-	-	-	-
	2019	2	2	2	2	-	-	1	-	-	-	-	-	-	-
	2020	2	1	1	-	4	-	2	-	1	-	1	-	1	-

* N: normal irrigation water salinity less than 3 g/l

** E: high irrigation water salinity, above 3 g/l

Plant materials

To guarantee the accuracy of the results, the varieties were subdivided into two to three different groups according to the number of times they were present in the trials (Table 2)

Table 2. Distribution of varieties

Region	Varieties
CapBon - salinité N	Perfectpeel, Albatros, Ercole, TopSport, CXD255, Savera, Heinz1423, Heinz1534, Heinz9661, Heinz1015 et Heinz5508.
	Vulcan, Axel, Dorra, Heinz7709, Heinz3402, Heinz4107, Heinz2206, Heinz1307, Heinz9036 et Heinz9997.
	Wally red, Saada, Vespro, Kero, Barnum, Firenze, Jawad, Badria, Farah, Heinz1292 et Heinz1293.
CapBon - salinité E	Savera, CXD255, Albatros, Vulcan, Heinz9661, Heinz7709, Heinz1015 et Heinz5508.
	Perfectpeel, Wally red, Ercole, Heinz4107 et Heinz3402.
	Vespro, JAG, Xico, Heinz1292, Heinz1293, Heinz2206, Kero, Chibli, Nemabrix, PrimoPake, Heinz1423, Heinz1534, Jawad, Badria et Early Fire.
Kairouan - salinité N	Perfectpeel, Albatros, TopSport, CXD255, Savera, Heinz9661 et Heinz1015.
	Heinz3402, Heinz4107, Heinz7709, Saada, Axel, Vulcan, Heinz1423, Heinz1534, Jawad, Heinz5508, Badria, Sun6200, Firenze, Heinz1292 et Heinz1293 et Heinz2206
Kairouan - salinité E	Perfectpeel, Savera, CXD255, Saada, Heinz1015 et Heinz7709.
	Heinz9661, Heinz2206, Heinz1301, Heinz9997, Heinz1423, Heinz1534, Heinz4107, Heinz3402 et Heinz5508
Gafsa - salinité N	Perfectpeel, Albatros, Badria, Jawad, CXD255, Heinz1423, Heinz1534, Heinz1015 et Heinz5508.
	Savera, Farah, Heinz3402, Heinz4107 et Heinz9661.
	Wally red, Axel, Ercole, Dorra, Heinz7709, Heinz2206, Heinz1292 et Heinz1293.
Gafsa - salinité E	Heinz3402, Heinz9661, Heinz7709, Heinz1015, Heinz4107, Heinz1292, Heinz1293 et Heinz2206.
Béja - salinité N	Perfectpeel, Albatros, CXD255, Ercole, Heinz1015, Heinz1423, Heinz1534, Heinz4107, Heinz9661, Heinz3402, Heinz5508 et Heinz7709.
	Savera, Nemageant, Farah, Badria, Axel, Heinz2206, Heinz1301, Heinz9997 et Heinz9036.
Jendouba - salinité N	Perfectpeel, Albatros, CXD255, Heinz1423, Heinz9661, Heinz5508, Heinz1015, Heinz4107 et Heinz1534.
Jendouba - salinité E	Heinz3402, Heinz7709, Heinz1015, Heinz4107, Heinz1292, Heinz1293 et Heinz2206.
Sidi Bouzid salinité N	Perfectpeel, Albatros, CXD255, Axel, Badria, Heinz1423, Heinz1534, Saada, Jawad, Heinz1015 et Heinz5508
Bouficha salinité N	Perfectpeel, Albatros, CXD255, Axel, Badria, Heinz1423, Heinz1534, Savera, Heinz1015 et Heinz5508

* N: normal irrigation water salinity less than 3 g/l

** E: high irrigation water salinity, above 3 g/l

Experimental design

In each station, the varieties are randomly distributed in a randomized block design with three replications. These sites are managed, at the cultivation level, in the same way as the production fields. The recommended irrigation method is the drip system associated with a localized fertilization "La Fertigation". The fertilization program adopted is that of the farmer to evaluate the behavior of the varieties subject to the trials. The fertilization doses as well as the quantities of irrigation water to be applied vary according to the type of soil, the quality of the irrigation water and the climatic characteristics of the growing region.

Analyses of productivity and fruit quality

For each trial parcel, preliminary analyses were performed during an intermediate stage (10 to 15 days before harvest) followed by a second phase of analysis at the final harvest date. During each phase of analysis, 5 samples were taken at random per block and per treatment (variety). Each sample consisted of all fruits (including green and rotten fruits) from the harvest of three randomly selected plants.

The processable yield per ha reflects the amount of healthy tomato per ha that can be processed after deducting the mass of waste (green and rotten fruits) per ha. The dry matter content is evaluated by the degree °Brix, measured with a digital hand-held refractometer.

The yield in °Brix per ha is the quantity of juice that can be obtained from the transformation of the production of one ha of healthy fruit after deducting the mass of waste. The reference potential is the yield in °Brix that can be obtained under ideal production conditions (yield produced = 100% of the expected yield) and with average waste rates of about 10% and average soluble sugar contents of about 5°Brix. The color is taken by direct reading of the a/b index on a colorimeter.

Estimated revenue generated by one ha for each variety of tomato based on the current price of the 2020 campaign (195 millimes per kg). The rates of green fruit and rotten tomatoes are deducted from the yield weight. To optimize the reliability of the results, all varieties studied in each region were aligned to a common expected yield.

Statistical analysis

The statistical analysis of the data was carried out using the program "SPSS Version 20.0.0". It was thus possible to verify each time if significant differences, at the 5% level, exist between the different treatments and the different blocks considered.

Characterization of the varieties

In order to facilitate the exploitation of the results obtained, we have tried to assess the importance of each quantitative or qualitative parameter for all the varieties studied by following an increasing scale from 1 to 5.

The database, the result of this work, will be updated each season to be available to manufacturers, nurseries, collectors and producers. It represents a useful tool for the varietal choice to select the most productive varieties and the most adapted to the transformation (grouped maturation, °Brix...) especially that the sector tends towards the adoption of a structure of payment to the quality of the tomato fruits.

We invite you to consult our detailed reports which are at your disposal.