Study of the industrial tomato varieties in the main production regions in Tunisia: Campaigns 2016 – 2021

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The cultivation of tomato industry in Tunisia occupies each year 15 to 18 thousand ha. During the campaign 2021, we processed 935 thousand tons of fresh tomatoes against 955 thousand tons in 2020. These quantities have allowed to produce 144 thousand tons of DCT in 2021 against 147 thousand tons of DCT in 2020; that is to say an industrial yield of about 6.5.

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 fT to produce 1 kg of Double Concentrate DCT in 2009 to 6.92 in 2015 and 6.5 kg fT / kg DCT for the period between 2016 and 2021. 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 44 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).

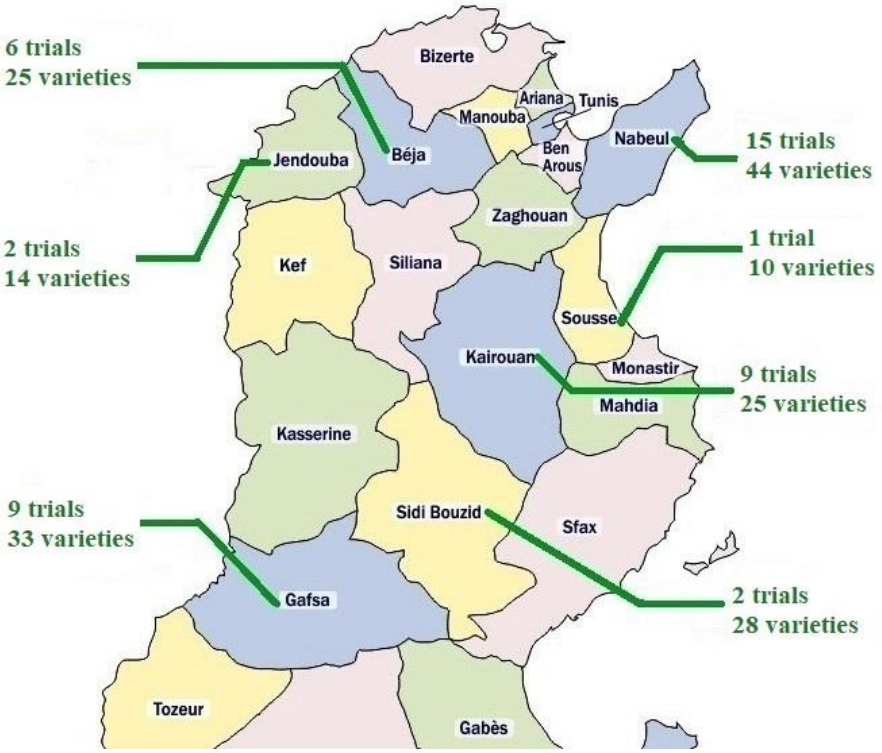


Figure 1: Map of trials locations.

Distribution of the trials

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

Before transplanting the seedlings, we proceeded to the coding of the varieties and to the application of the same cultural conduct (irrigation, fertilization, phytosanitary treatments...) for all varieties in each site.

Table 1. Distribution of trials according to seasons, crop regions and irrigation water quality

Region		CapBon		Kairouan		Gafsa		Beja		Jendouba		Sidi Bouzid		Bouficha	
Number of overall trials		15		9		9		6		2		2		1	
Salinity of irrigation water		N*	E**	N	N	N	E	N	E	N	E	N	E	N	E
Number of trials		10	5	5	4	8	1	6	-	1	1	2	-	1	-
Number of varieties		38	28	23	15	33	8	25	-	9	7	28	-	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	-
	2021	2	-	-	-	2	-	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	Repetitions	Variety
CapBon - salinity N*	4 trials or more	Perfectpeel, Albatros, Ercole, Topsport, CXD255, Savera, H1423, H1534, H9661, H1015, H5508, H4107, H7709 et Dorra.
	2 to 3 trials	Vulcan, Axel, H3402, H2206, H1301, H9036, H9997, Jawad, Badria, Farah, H1879, H1884 et H1886.
	A single trial	Wally red, Saada, Vespro, Kero, Barnum, Firenze, H1292, H1293, Noura, Pietrarossa et Alysse.
CapBon - salinity E**	3 trials or more	Savera, CXD255, Albatros, Vulcan, H9661, H7709, H1015 et H5508.
	2 trials	Perfectpeel, Wally red, Ercole, H4107 et H3402.
	A single trial	Vespro, JAG, Xico, H1292, H1293, H2206, Kero, Chibli, Nemabrix, PrimoPake, H1423, H1534, Jawad, Badria et Early Fire.
Kairouan - salinity N	2 trials or more	Perfectpeel, Albatros, Topsport, CXD255, Savera, H9661 et H1015.
	A single trial	H3402, H4107, H7709, Saada, Axel, Vulcan, H1423, H1534, Jawad, H5508, Badria, Sun6200, Firenze, H1292, H1293 et H2206
Kairouan - salinity E	3 trials or more	Perfectpeel, Savera, CXD255, Saada, H1015 et H7709.
	1 or 2 trials.	H9661, H2206, H1301, H9997, H1423, H1534, H4107, H3402 et H5508

Region	Repetitions	Variety
Gafsa - salinity N	4trials or more	Perfectpeel, Albatros, Badria, Jawad, CXD255, H1423, H1534, H1015, H5508, Farah et H9661.
	2 to 3 trials	Savera, H3402, H4107, Dorra, H7709, Ercole, Elba, Wasco, Firenze, Gladis et Noura
	A single trial	Wally red, Axel, Ercole, H2206, H1292, H1293, Sabra, Saada, H1879, H1884 et H1886.
Gafsa - salinité E	A single trial	H3402, H9661, H7709, H1015, H4107, H1292, H1293 et H2206.
Béja - salinity N	2 trials or more	Perfectpeel, Albatros, CXD255, Ercole, H1015, H1423, H1534, H4107, H9661, H3402, H5508, H7709 et Farah.
	A single trial	Savera, Nemageant, Badria, Axel, H2206, H1301, H9997, H9036, Dorra, H1879, H1884 et H1886.
Jendouba - salinité N	A single trial	Perfectpeel, Albatros, CXD255, H1423, H9661, H5508, H1015, H4107 et H1534.
Jendouba - salinity E	A single trial	H3402, H7709, H1015, H4107, H1292, H1293 et H2206.
Sidi Bouzid - salinity N	2020 trial	Perfectpeel, Albatros, CXD255, Axel, Badria, H1423, H1534, Saada, Jawad, H1015 et H5508
	2020 trial	CXD255, Saada, Topsport, H9661, Savera, Dorra, H1879, H1884, H1886, H4107, Ercole, Gladis, Elba, Wasco, Sabra, Noura, Firenze, H7709 et Farah
Bouficha - salinity N	Un seul essai	Perfectpeel, Albatros, CXD255, Axel, Badria, H1423, H1534, Savera, H1015 et H5508

* 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.

Color is taken by direct reading of the a/b index on a colorimeter.

In order to optimize the reliability of the results related to the parameters of yield in tons of °Brix per ha and the revenue generated per ha, all the varieties studied were aligned to a common expected yield of 100 tons per ha.

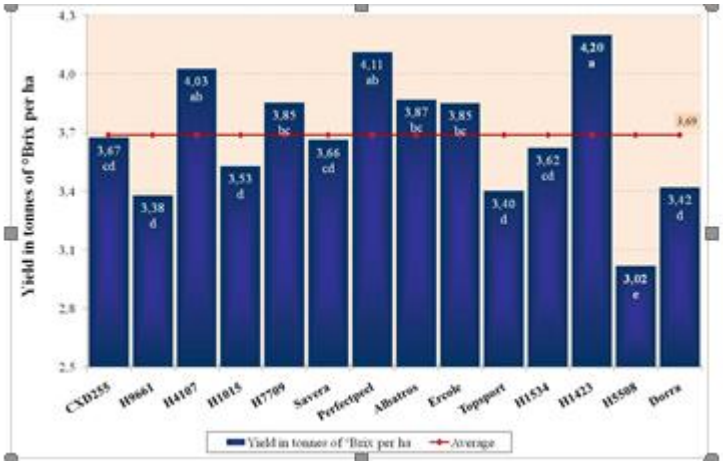
The yield in °Brix per ha is the amount of juice that can be obtained from the transformation of the production of one ha of healthy fruit after deduction of the mass of waste.

The estimated revenue generated by one ha for each variety of tomato is based on the current price of the 2021 campaign (195 millimes per kg).

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.

- In the form of a histogram relative to the variation of each parameter:



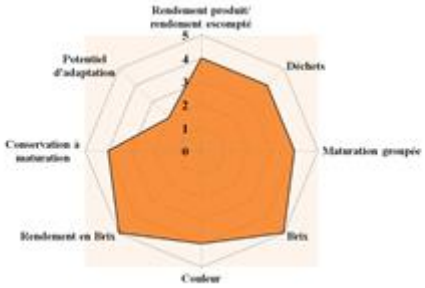
- In the form of a synthesis table of the characteristics in each of the regions:

Variety	Yield in Brix	Waste rat	Color index	°Brix	Grouped maturation	Preservation with maturation	Total yield/target	Phytosanitary tolerance	Fruit coverage	Vegetative Vigor
CXD255	+++	++	++	+++	+	+++	++	4	4	4 - 5
Savera	+	-	+	++	-	+	+++	4 - 5	4	4 - 5
Albatros	++	++	+	+++	+	++	+	3 - 4	3 - 4	4
Perfectpeel	+++	+++	+++	+++	++	+++	++	3 - 4	3 - 4	3 - 4
Heinz4107	+++	++	++	+++	++	++	++	3 - 4	3 - 4	3 - 4

- In the form of classification tables with a score for each type of potential:

Variety	Productive potential/ 30	Quality potential/ 40	Adaptation potential/ 30	Overall score/ 100
CXD255	17,5	30	22	**69,5**
Perfectpeel	22,5	30	16,5	**69,0**
Albatros	20	25	18	**63,0**
Savera	17,5	10,0	25,5	**53,0**
Heinz1015	20	25	7	**52,0**

- In the form of a star showing all the possible varietal potential of each of the varieties expressing the behavior on a regional scale:



- In the form of summary sheets of the characteristics and behaviour of the varieties

<table>
<tr><td>3/ 50</td><td colspan="3">Perfectpeel
Advantages : Transformable yield - Grouped ripening - Jointless - EFS - Brix content - Color - Firmness</td><td>25 trials/ 44</td></tr>
<tr><td>Features</td><td>Variété moyennement vigoureuse avec un cycle de culture moyen.
Potentiel productif bon 85% - 90% du rendement escompté, dépend de la conduite culturale.
Rendement transformable très bon à excellent ≥ 90% du rendement produit par ha.
Croissance végétative qui assure une bonne à très bonne couverture des fruits.</td><td>Maturation groupée très bonne à excellente à condition de respecter le cycle de culture.
Variété qualifié Jointless avec une excellente aptitude pour la conservation de la texture des fruits matures.
Très bonne teneur en sucres solubles 5 – 5,3 °Brix avec une salinité courante.
Intensité de la coloration rouge des fruits matures très bonne à excellente.</td><td colspan="2">Rendement en Brix bon 4 – 4,5 tonnes de Brix par ha (pour un rendement escompté de 100 tonnes/ ha).
Fruits fermes de petit calibre, poids moyen de 60 - 70 g.
Résistance : V, F, A</td></tr>
<tr><td>Normal salinity - 20 trials</td><td colspan="4">CapBon : 5 essais

<table><tr><td>Productive potential/ 30</td><td>Quality potential/ 40</td><td>Adaptation potential/ 30</td><td>Overall score/ 100</td></tr><tr><td>17,5</td><td>25</td><td>12,5</td><td>55</td></tr></table>
Kairouan : 5 essais

<table><tr><td>Productive potential/ 30</td><td>Quality potential/ 40</td><td>Adaptation potential/ 30</td><td>Overall score/ 100</td></tr><tr><td>22,5</td><td>30</td><td>16,5</td><td>69</td></tr></table></td></tr>
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Conclusion

The database, result of this work, will be updated every season to be available to industrialists, nurseries, collectors and producers. It represents a useful tool during 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 tomato fruits.

We invite you to consult the detailed reports available at the GICA headquarters.

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