TWO DECADES OF EVALUATION OF PROCESSING TOMATOES CULTIVARS IN PORTUGAL: PROGRAMMES METI, METIBER AND EC-AMITON TRIALS

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Abstract

The aim of this presentation is to report on experiments that have been done in Portugal from 1970 to date and also to describe the behaviour of tomato cultivars over this period, evaluated both for their agronomic and technological features.

Cultivars were ranked on the basis of agronomic and technological evaluation following methodology adapted from the SONITO procedures.

The best five cultivars in each year and their most important characteristics - yield, $^{\circ}$Brix, and soluble solids (t/ha) - are presented.

1. Introduction

At the beginning of the 1970s a research project called "The Mechanized Production of Tomatoes for Processing" (METI) was set up under the leadership of the University of Évora and together with the main tomato processing companies in Portugal. One of its priorities was the evaluation of new cultivars by means of observation and production trials. In 1982 the list of collaborators on the project was extended to involve participants from Spanish Estremadura and the METIBER programme was born. Since 1992 the setting up of field experiments began to be done through the EC-CAMAR Programme "Processing Tomato Technological Quality Improvement".

The final objective of this poster is to present the five best cultivars in each year and their most important characteristics.

2. Material and methods

At the beginning trials were carried out in the three main tomato-producing regions in Portugal (the Tagus, Sado and Caia valleys); since 1980 trials have been carried out only in the Tagus Valley region on alluvial loamy soils. Statistical design have been always that of randomized blocks with plots of 10m x 1.5m and four replications.

From 1975 to 1992 20 cultivars were sown by means of direct sowing; in the first three years crops were sought which could be harvested twice manually and gradually substituted by concentrated - set cultivars to be harvested only once. Since 1992 twenty cultivars have continued to be sown by means of transplantation, with 'UC 82 B' and 'H7151' being used as standards. The former was the control to the trials carried out with regard to the EC project CAMAR. The latter was chosen as a variety which is used widely by Portuguese farmers.

The general methodology used in field trials is shown in table 1.

For the results obtained only one harvest was carried out when 80% of the fruit were red or orange in colour. The produce was sorted into more red and orange coloured fruit

(commercial produce), unripe fruit, rotting fruit and sunscalded fruit. Taking a sample of 100 units obtained in each replication the average weight the shape, the % of fruit with stalks, blossom-end rots, unripe blotches, splits and firmness was determined. A sample of 2.5Kg of ripe fruit was taken in each replication the trial to determine the indices of technological quality: °Brix, pH, total acidity, colour and viscosity (Bostwick).

The cultivars were only evaluated on the basis of fruit production levels up until 1977, and since 1982 they have been evaluated on the basis of their agronomic and technological characteristics after the "College trials" methodology adopted in SONITO.

3. Results and conclusions

3.1. Evolution of production and °Brix

An analysis of figures 1 and 2 shows that average production and the average °Brix of the five best cultivars in each year of trials have not demonstrated any tendency towards increasing and that their values show a marked variation between years, which is independent of production levels. Thus it can be seen that this variation is greater for production than for °Brix.

3.2. The variability of production

Looking at table 3 we see that the cultivars show different levels of variation between years; for example 'Cannery Row' has a very low coefficient of variation; however, in the years in which it was studied it was only among the five best cultivars in one year.

'Joaquin', 'Casthely Hy 1017', 'GS27', 'H7151' and UC 204' show average coefficients of variation. 'K549', 'Nema 1400', 'H30', 'Italpeel', 'E6203', 'Cal j', 'Rio Grande', and 'Hibrido 31' are those with the highest coefficients of variation. Meanwhile, 'Nema 1400' is frequently among the five best cultivars throughout the whole trial period.

3.3. °Brix

The cultivars which stand out are: 'Nema 1400', 'H7151', 'E6203' and 'Casthley Hy 1017' (table 3). 'UC204', 'Italpeel', 'Hibrido 31', 'H30', 'Cannery Row' and 'GS27', also have °Brix equal or above 5.

3.4. The cultivars of most interest

The cultivars which most frequently appear among the five best are: 'GS27', 'Nema 1400', 'Joaquin', 'Casthley Hy 1017' and 'H7151' (table 3). 'GS27', 'Casthley Hy 1017', and 'Joaquin' stand out as cultivars which have no interest for us on account of the high price of seeds (hybrids).

'K549', 'Italpeel', 'E6203', 'Rio Grande','Cal j', 'H30' and 'Cannery Row' are often among the ten best cultivars (table 3). It should be noted that 'K549' is a hungarian variety which has never been sold on the Portuguese market, 'Cal j' has experienced a significant period of expansion, 'Italpeel' and 'Rio Grande' are widely cultivated, and 'H30' continues to be marketed.

References

METI - "Divulgando", 1975 a 1979. Évora, Universidade de Évora n°s 19 a 24.

Portas, C.A.M., Oliveira, W., Stilwell, M.R., Calado, A.M., Dias, V.M.B. and Ruiz-Altisent, M., 1986. The tomato processing industry in Portugal. Hortscience 21(1):18-20.

Taborda, M.L.; Machado, R.M.A., 1992. Evaluation agronomique et technologique de cultivars de tomate pour l'industrie. "Tomato News" 6/92:66-71.

Taborda, M.L.; Machado, R.M.A., 1993. Resultats des essais varietaux de tomate d'industrie. "Tomato News" 6/93:54-57.

SONITO, 1982. Le choix varietal en tomate de conserve - essais collegiaux. 54 Chemin de Bonaventure 84000 Avignon.

Table 1 - General methodology used in field trials

|	1977 to 1991	1992 to 1993
Statistical design	Randomized blocks, four replications	
Size of the plot (m²)	$10 \times 15 = 15$ m²	
number of beds and row	1 bed 1 row	
Plant population (10^3 ha^{-1})	66	44
Method of planting	Direct sowing	Pot transplanting
Method of harvesting	Once (hand) harvest	
Number of cultivars	20	
Standard cultivar	'Cal J'	'UC 82 B and 'H 7151'
Sowing or planting dates	Until 2nd half of April	Until 2nd half of May
Distance between plants (cm)	0.10	0.15
Fertilization (N - P$_2$O$_5$ - K$_2$O)		
Pre-planting	35 - 105 - 105	60 - 100 -100
After emergence/planting	105 - 0 - 0	60 - 0 - 0
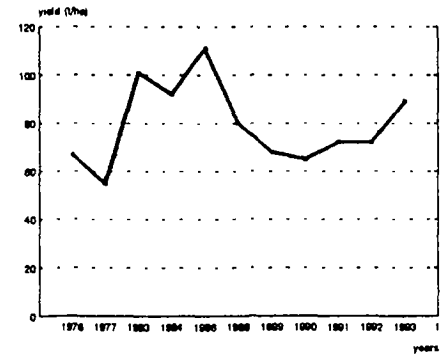
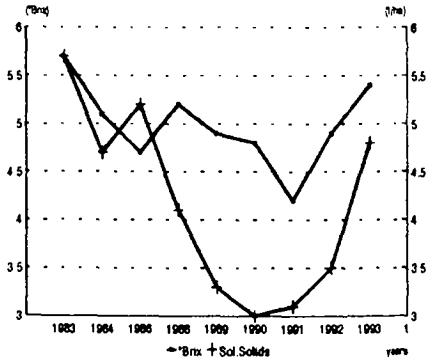Figure 1 - Average production (t/ha) of the five best cultivars in each year of trial

Figure 2 - °Brix and solubles solides (t/ha), average of the five best cultivars in each year of trial

Table 2 - The five best cultivars in each year of trial (*)

Year	Cultivars	Yield (t/ha)	*Brix	Solubles solides (t/ha)
1976 (1)	Castle 316	71	-	-
	Cal J	69	-	-
	VF 270	67	-	-
	H 4014	66	-	-
	H 4017	63	-	-
1977 (1)	H 2826	66	-	-
	H 30	56	-	-
	VC 82	55	-	-
	Bulker	52	-	-
	Euromech	45	-	-
1983	Joaquin	107	6.2	6.6
	GS 33	101	5.5	5.5
	E 6203	90	6.1	5.5
	GS 27	103	5.3	5.4
	Castley Hy 1017	102	5.3	5.4
1984	GS 33	101	4.7	4.8
	GS 27	95	5.0	4.7
	Castley Hy 1017	83	5.7	4.7
	Rio Grande	88	5.2	4.6
	Joaquin	92	4.9	4.5
1986	Nema 1400	108	5.2	5.6
	Castley Hy 1017	120	4.5	5.4
	Italpeel	112	4.6	5.1
	Rio Grande	106	4.7	5.0
	H 4033	110	4.5	4.9
1988	Italpeel	85	5.6	4.7
	Nema 1400	78	5.4	4.2
	PGI 1103	84	4.7	4.0
	NS 203	79	5.0	3.9
	PGI 1101	73	5.3	3.9
1989	Italpeel	75	5.0	3.7
	Nema 1400	65	5.2	3.4
	H 30	69	4.8	3.3
	PGI 1103	68	4.6	3.1
	NS 203	64	4.7	3.0
1990	Nema 1400	69	5.0	3.3
	H 2710	71	4.4	3.1
	Zenith	71	4.3	3.1
	Del Oro	56	5.2	2.9
	FMX 922	56	4.9	2.7
1991	NS 202	85	4.2	3.6
	EMX 1031 N	73	4.1	3.0
	Nema 316	72	4.1	3.0
	Nema 1401	65	4.4	2.9
	HMX 3094	66	4.2	2.8
1992	H 7151	77	4.7	3.6
	Nema 1400	66	5.4	3.6
	Early Mech	82	4.2	3.4
	H 4002	61	5.2	3.2
	PGI-E-537	75	5.1	3.8
1993	H 4074	96	5.3	5.1
	Centurion	91	5.4	4.9
	H 7151	88	5.5	4.8
	Early Mech	89	5.0	4.5
	Brigade	79	5.6	4.5

(*) - This excludes four more years of trials with abnormal production values.
(1) - Up until 1977 the evaluation of cultivars was only done on the basis of production.

Table 3 - An overall analysis of the cultivars under trial for three or more years for three or more years

Cultivar	Average production (t/ha)	Coefficient of variation between years (*)	(1)	(2)	Average *Brix	Coefficient of variation between years (**)
GS 27	113	b	100.0	100.0	5.0	b
Nema 1400	69	c	71.4	71.4	5.4	a
Castley Hy 1017	102	b	66.7	100.0	5.2	b
Joaquin	108	b	66.7	66.7	4.9	c
H 7151	66	b	40.0	80.0	5.3	a
K 549	105	c	33.3	100.0	4.4	b
Italpeel	71	c	33.3	100.0	5.1	a
H 30	76	c	30.0	50.0	5.1	b
Cannery Row	69	a	25.0	50.0	5.0	a
Cal J	67	c	18.2	54.5	4.8	b
E 6203	78	c	14.3	57.1	5.2	b
Hibrido 31	69	c	12.5	25.0	5.1	a
Rio Grande	65	c	0.0	57.1	4.9	a
UC 204	84	b	0.0	33.3	5.1	a

(*) - a - 0 - 10%, b - 10 - 20%, c - >20%
(1) - % of years in which the cultivar was among the five best
(2) - % of years in which the cultivar was among the ten best
(**) - a - 0 - 8%, b - 8 - 16%, c - >16%