

EXECUTIVE SUMMARY
2018-2019 ORANGE CROP FORECAST
FOR SÃO PAULO AND WEST-SOUTHWEST
OF MINAS GERAIS CITRUS BELT



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2018/2019 ORANGE CROP FORECAST FOR SÃO PAULO AND WEST-SOUTHWEST OF MINAS GERAIS CITRUS BELT MAY/2018 STATUS

The 2018/2019 orange crop forecast published on May 09, 2018 by Fundecitrus, in cooperation with Markestrat, FEA-RP/USP and FCAV/Unesp¹ is of 288.29 million boxes of 40.8 kg each. This total includes:

- 55.81 million boxes of the Hamlin, Westin and Rubi varieties;
- 16.55 million boxes of the Valencia Americana, Seleta and Pineapple varieties;
- 81.16 million boxes of the Pera Rio variety;
- 99.80 million boxes of the Valencia and Valencia Folha Murcha varieties;
- 34.97 million boxes of the Natal variety.

1 – BEARING TREES

Bearing trees of the varieties which make up this estimate total 175.27 million. Information about bearing trees was obtained from the Tree Inventory for São Paulo and west-southwest of Minas Gerais citrus belt: March 2018 status, defined by the new mapping of groves performed from September 08, 2017 to January 29, 2018 and by counting of trees present in 5% of plots mapped, from January 29 to March 07, 2018

The georeferenced mapping, carried out for the first time at the 2015 Inventory, has been through a complete update for this 2018 Inventory. New high definition orthorectified images were obtained by the satellites SPOT 6&7 from European Airbus Defence and Space between May and August, 2017. In September, 2017 images were made available to survey agents, together with drawings of plots identified in the previous mapping, which were superimposed to the images for easier visualization of areas that should be visited to collect *in loco* data. Scanning or visual inspection of images were also employed by survey agents before they went to the field to pre-identify citrus groves planted after the previous mapping from 2015 to 2017, which should also be visited.

No information relative to the plot other than their outlines was supplied to survey agents, which required all new data to be collected on: variety, year set, spacing, visual aspect of plants and irrigation system, when present². Recently collected data relative to the variety and year set that differed from the previous register were audited for validation. Outlines of plots were redrawn to correspond to their present area, whenever their area was changed after plots having been registered in the previous mapping. Field visits identified plots that were abandoned or eradicated after the 2015 Inventory, and those identified in that mapping as being in a similar situation, so that they were also revisited for updating data. A new feature in the current mapping is the delimitation of farms, which more precisely quantifies farms present in the citrus belt.

For the tree inventory, five percent of mapped orange plots were drawn to be visited again and to have their planting holes classified and quantified. Each tree present in the plot was classified into one of four age groups: zero (up to two years old), one (from three to five years old), two (from six to ten years old) and three (over ten years old). Dead and missing trees were also accounted for. Plots were chosen through a random drawing that employed the proportionate stratified sampling technique. Stratification variables were: 12 regions, five orange varieties groups and four age groups, totaling 240 strata.

2 – FRUIT PER TREE

The average number of fruit per tree in April/2018, without considering the drop to occur throughout the season, is of 564 fruit per tree.

The high number of fruit in the 2017/1018 crop in addition to unfavorable conditions caused mainly by high temperatures in October led to a reduced fruit setting for the main bloom in regions with later flowering. More favorable conditions in the regions of Duartina, Avaré and Itapetininga triggered better flowering and fruit setting for the first bloom.

Approximately 2,200 trees were stripped of fruit. They were distributed proportionally to the total of orange trees in the citrus belt and were stratified according to region, variety and age. The random drawing employed

¹ Department of math and science, Jaboticabal.

² Procedures described were used for Orange. For other citrus, a simplified mapping methodology was chosen.

the proportionate stratified sampling technique. For an increased estimate precision, more than 360 trees below the age of the groups in their groves were stripped. Those trees were resets planted mainly to offset losses caused HLB (huanglongbing or greening), citrus canker and other diseases. Trees were stripped from March 15 to April 25, 2018.

The average number of fruit per tree may vary in 13 fruit, plus or minus, which is equivalent to 2,3% of the average number of fruit per tree at stripping. This figure is in accordance to the expected error of 2% to 3% used in sizing the sample. The yield deviation distribution analysis for each stripped tree in relation the stratum average shows that sample data are randomly distributed according to a normal distribution.

3 – DROP RATE

The estimated average drop rate is of 17.0%. This figure is projected from the perspective of a drier year with temperatures above standard as of October, according to information presented by the meteorological company Climatempo in April, 2018. The increased severity of HLB observed in the last two years is likely to continue in this season, which accentuates the early fruit drop, even in a year of less fruit per tree.

4 – FRUIT PER BOX

The average size is estimated at 256 fruits per box of 40.8 kg. This figure is projected from the perspective described in the previous item.

In order to further support the projection for the final fruit size, a regression model was created considering the final fruit size at harvest as the dependent variable and the number of fruits per tree at stripping, initial fruit size (fruits per box at stripping) and rainfall accumulated from May to July as independent variables. The model used data from the last ten crops, 2008/2009 to 2017/2018³. The result obtained shows an adjusted R² of 0.87 and an average error in the projection of fruit size of ± 3%. Data from this year's stripping and rainfall from May to July, 2018, which was close to climatological averages (1981-2010) were used to project the final fruit size for this season.

OBJETIVE SURVEY METHOD FOR ORANGE CROP FORECAST

In order to perform this forecast, the objective method used in previous seasons was maintained, which is based on quantitative data – field measurements, counting and weighing of fruit – applied to the direct expansion model whose formula is shown below. The result from this equation needs to be corrected according to variable not considered in the forecast model, such as different planting densities of plots, which are not included in the stratification of groves, or the loss of trees along the season due to eradications, abandonments or deaths. The correction factor (CF) of 0.10 is the same used in the 2017/1018 season.

$$\text{Production forecast} = \frac{\text{Bearing trees} \times \text{Fruit per tree} \times (1 - \text{Drop rate}) \times (1 - \text{CF})}{\text{Fruit per box}}$$

The orange crop forecast and its components by variety group are shown in Table 1.

³ Data on fruit per tree, initial and final fruit size for the series of 2008/2009 to 2014/2015 were provided by orange juice companies associated to Fundecitrus – Citrusuco, Cutrale and Louis Dreyfus, which, individually, have estimated their crop for the citrus planted area since 1988, through objective methodology. Data for the 2015/2016 and 2016/2017 crops result from estimates performed by Fundecitrus.

Table 1 – 2018/2019 Orange crop forecast and its components by variety group

Variety group	Mature groves area	Average density ¹	Components of May 2018 forecast				2018/2019 Orange crop forecast		
			Bearing trees	Fruit per tree at stripping ²	Fruit estimated per box	Estimated drop rate	Per tree	Per hectare	Total
			(1,000 trees)	(number)	(fruit/box)	(%)	(boxes/tree)	(boxes/hectare)	(1,000,000 boxes)
Early season:									
Hamlin, Westin and Rubi.....	60,870	452	26,649	766	292	11.0	2.09	917	55.81
Other early season:									
Valencia Americana, Seleta, Pineapple.....	18,103	452	7,959	664	255	11.0	2.08	914	16.55
Mid Season:									
Pera Rio.....	124,920	503	61,575	454	255	17.5	1.32	650	81.16
Late:									
Valencia e V.Folha Murcha ³	130,637	465	59,583	560	240	20.0	1.67	764	99.80
Natal.....	43,893	455	19,503	603	240	20.5	1.79	797	34.97
Average.....	(X)	474	(X)	564	256	17.0	1.64	762	(X)
Total.....	378,423	(X)	175,269	(X)	(X)	(X)	(X)	(X)	288.29

(X) Not applicable.

¹ Calculation considers the total number of trees in the plot, that is, bearing and non-bearing trees (2015 or 2016 resets).

² Weighted average per total stratum fruit.

³ V.Folha Murcha – Valencia Folha Murcha.

Results compiled from the inventory and the stripping of trees, obtained throughout the survey, were restricted until the date of this publication, to the following professionals: Antonio Juliano Ayres (general manager of Fundecitrus), Fernando Alvarinho Delgado, Renato Tadeu Rovarotto and Roseli Reina (PES supervisors), Vinícius Gustavo Trombin (executive coordinator for Markestrat), Marcos Fava Neves (political-institutional coordinator linked to FEA-RP/USP and Markestrat) and José Carlos Barbosa ((coordinator of methodologies linked to the Department of Math and Science of the FCAV/Unesp). All of them are subject to confidentiality obligations with regard to PES information before its announcement is made public, according to agreements signed between each of them and Fundecitrus. As for antitrust practices, all of them were complied with through the adoption of measures necessary to prevent any communication or sharing of individual information with a competitive content among the orange juice companies that collaborate with Fundecitrus in this project or between these and citrus growers. This team, together with Fundecitrus Chairman, Lourival Carmo Monaco, concluded the crop forecast on May 9, 2018 at 9:30 a.m., in a closed meeting, devoid of any communication channel beyond participants. Next, the Fundecitrus Chairman made the final information public starting at 10 a.m. at the auditorium at Fundecitrus, in Araraquara-SP, broadcast live online. A presentation of the detailed data was given by the general manager of Fundecitrus, Antonio Juliano Ayres.

This executive summary was approved on May 9, 2018. The full report on the tree inventory and the 2018/2019 crop forecast will be available on May 21, 2018 at www.fundecitrus.com.br.

TABLES

The following tables present the 2018/2019 orange crop forecast by sector, age, bloom and variety. The margin of error in the production forecast for the strata is greater than the production forecast for the citrus belt as a whole. Variations that may occur in fruit size and drop rate can change the forecast and will be determined throughout the season by constant field monitoring for crop forecast updates.

Table 2 – 2018/2019 Orange crop forecast by sector

Sector	Mature groves area	Mature groves average density ¹	Bearing trees	Fruit per tree at stripping ²	2018/2019 Orange crop forecast		
					Per tree	Per hectare	Total
	(hectares)	(trees/hectare)	(1,000 trees)	(number)	(boxes/tree)	(boxes/hectare)	(1,000,000 boxes)
North.....	85,275	470	39,323	456	1.33	612	52.19
Northwest.....	40,139	461	18,350	314	0.92	419	16.82
Central.....	106,140	470	48,593	533	1.56	714	75.76
South.....	76,458	464	34,335	592	1.72	773	59.09
Southwest.....	70,411	502	34,668	834	2.44	1199	84.43
Total.....	378,423	474	175,269	564	1.64	762	288.29

¹ Calculation considers the total number of trees in the plot, that is, bearing and non-bearing trees (2015 or 2016 resets).

² Weighted average per total stratum fruit.

Table 3.1 – 2018/2019 Orange crop forecast by tree age group (continues)

Age of plots	Mature groves area	Average density of mature groves	Bearing trees by age group				Fruit per tree at stripping by age group of trees ²			
			3 – 5 years	6 – 10 years	Over 10 years	Total	3 – 5 years	6 – 10 years	Over 10 years	Total
	(hectares)	(trees/hectare)	(1,000 trees)	(1,000 trees)	(1,000 trees)	(1,000 trees)	(fruit/tree)	(fruit/tree)	(fruit/tree)	(fruit/Tree)
3 – 5 years.....	37,472	636	22,996	-	-	22,996	234	-	-	234
6 – 10 years.....	123,238	540	2,202	62,780	-	64,982	107	493	-	480
Over 10 years.....	217,713	408	2,940	4,955	79,396	87,291	131	265	763	713
Total.....	378,423	474	28,138	67,735	79,396	175,269	213	476	763	564

- Represents zero.

¹ Calculation considers the total number of trees in the plot, that is, bearing and non-bearing trees (2015 or 2016 resets).

² Weighted average per total stratum fruit.

Table 3.2 – 2018/2019 Orange crop forecast by tree age group (continued)

Age of plots	2018/2019 Orange crop forecast by tree age group				2018/2019 Orange crop forecast by tree age group			
	3 – 5 years	6 – 10 Years	Over 10 years	Total	3 – 5 years	6 – 10 years	Over 10 years	Total
	(boxes/tree)	(boxes/tree)	(boxes/tree)	(boxes/tree)	(1,000,000 tree)	(1,000,000 boxes)	(1,000,000 boxes)	(1,000,000 boxes)
3 – 5 years.....	0.69	-	-	0.69	15.82	-	-	15.82
6 – 10 years.....	0.31	1.44	-	1.40	0.68	90.32	-	91.00
Over 10 years.....	0.38	0.77	2.22	2.08	1.13	3.81	176.53	181.47
Total.....	0.63	1.39	2.22	1.64	17.63	94.13	176.53	288.29

Table 4 – 2018/2019 Orange crop forecast by bloom

Bloom	2018/2019 Orange crop forecast	Percentage of the orange crop forecast per bloom
	(1,000,000 boxes)	(percentage)
1 st	203.94	70.75
2 nd	36.66	12.72
3 rd	38.33	13.29
4 th	9.36	3.25
Total.....	288.29	100.00

