Current forecast update (variation regarding the September forecast): **December, 11 2023**

Total orange crop production forecast: 307.22 million boxes (decreased of 0.7%)
Hamlin, Westin and Rubi: 58.09 million boxes (unchanged)
Other early season: 18.51 million boxes (unchanged)
Pera Rio: 97.62 million boxes (increased of 1.0%)
Valencia and Valencia Folha Murcha: 105.20 million boxes (decreased of 0.03%)
Natal: 27.80 million boxes (decreased of 9.8%)

Publication Schedule 2023-2024

3rd Crop forecast update: February 09, 2024
Final crop forecast: April 10, 2024

Table 1 – Orange crop forecast update by sector and variety group – citrus belt

Month Sector and variety group	Forecast components September/2023 and December/2023 (strike-through values were presented in September, to their left are their respective values updated in December)				Crop forecast update 2023-2024 September/2023			Crop forecast update 2023-2024 December/2023		
	Bearing trees	Fruit per tree at stripping	Fruit estimated per box	Estimated drop rate	Per tree	Per hectare	Total	Per tree	Per hectare	Total
	(1,000 trees)	(number)	(number)	(percentage)	(boxes/tree)	(boxes/hectare)	(1,000,000 boxes)	(boxes/tree)	(boxes/hectare)	(1,000,000 boxes)
CITRUS BELT										
Hamlin, Westin and Rubi....	25,716.04	828	293	10.8	2.26	1,047	58.09	2.26	1,047	58.09
Other early..........................	9,866.33	597	251	12.1 ~~12.0~~	1.88	987	18.51	1.88	987	18.51
Pera Rio..............................	61,508.67	563	258 ~~249~~	19.0 ~~22.5~~	1.57	829	96.68	1.59	837	97.62
Valencia and Folha Murcha	53,648.92	653	233 ~~222~~	22.0 ~~25.5~~	1.96	970	105.23	1.96	969	105.20
Natal...................................	18,551.19	573	244 ~~227~~	28.9 ~~26.5~~	1.66	818	30.83	1.50	738	27.80
Total.................................	**169,291.15**	**635**	**255 ~~247~~**	**19.0 ~~21.0~~**	**1.83**	**918**	**309.34**	**1.81**	**911**	**307.22**
NORTH SECTOR										
Hamlin, Westin and Rubi....	6,503.91	1,005	289	7.2 ~~7.3~~	2.88	1,242	18.74	2.89	1,246	18.79
Other early..........................	2,191.81	779	246	8.6 ~~9.0~~	2.58	1,395	5.66	2.60	1,403	5.69
Pera Rio..............................	13,535.28	592	255 ~~242~~	15.5 ~~19.5~~	1.76	939	23.86	1.75	934	23.75
Valencia and Folha Murcha	12,926.93	798	221 ~~214~~	19.0 ~~22.9~~	2.58	1,187	33.33	2.62	1,205	33.83
Natal...................................	3,774.50	655	223 ~~219~~	18.3 ~~23.9~~	2.04	932	7.69	2.05	940	7.75
Subtotal............................	**38,932.43**	**746**	**248 ~~241~~**	**14.7 ~~17.7~~**	**2.29**	**1,104**	**89.28**	**2.31**	**1,110**	**89.81**
NORTHWEST SECTOR										
Hamlin, Westin and Rubi....	1,994.68	582	276	6.6 ~~7.3~~	1.75	833	3.49	1.76	840	3.52
Other early..........................	1,718.19	414	245 ~~244~~	15.2 ~~15.8~~	1.28	677	2.20	1.29	680	2.21
Pera Rio..............................	6,669.81	611	241 ~~242~~	11.5 ~~17.5~~	1.87	858	12.44	2.01	923	13.39
Valencia and Folha Murcha	3,058.93	725	219 ~~229~~	14.1 ~~29.5~~	2.00	993	6.12	2.55	1,264	7.79
Natal...................................	1,556.98	508	220 ~~246~~	23.8 ~~28.9~~	1.32	633	2.05	1.57	756	2.45
Subtotal............................	**14,998.59**	**597**	**239 ~~244~~**	**12.9 ~~20.0~~**	**1.75**	**839**	**26.30**	**1.96**	**937**	**29.36**
CENTRAL SECTOR										
Hamlin, Westin and Rubi....	6,606.99	747	290 ~~289~~	9.6 ~~9.8~~	2.08	1,036	13.77	2.09	1,036	13.78
Other early..........................	3,473.28	677	247	12.3 ~~13.0~~	2.14	1,114	7.42	2.15	1,123	7.48
Pera Rio..............................	17,927.80	570	257 ~~248~~	24.3 ~~25.2~~	1.54	840	27.61	1.50	819	26.94
Valencia and Folha Murcha	15,036.66	574	237 ~~226~~	21.5 ~~26.6~~	1.67	870	25.12	1.70	885	25.57
Natal...................................	4,631.97	567	248 ~~235~~	31.6 ~~23.1~~	1.66	813	7.69	1.40	684	6.47
Subtotal............................	**47,676.70**	**603**	**255 ~~247~~**	**20.6 ~~21.8~~**	**1.71**	**895**	**81.61**	**1.68**	**880**	**80.24**
SOUTH SECTOR										
Hamlin, Westin and Rubi....	4,966.73	855	303 ~~302~~	17.5 ~~17.6~~	2.09	979	10.36	2.09	979	10.36
Other early..........................	542.68	342	274	16.7 ~~17.0~~	0.92	442	0.50	0.94	451	0.51
Pera Rio..............................	11,764.73	530	260 ~~255~~	21.9 ~~23.6~~	1.42	751	16.73	1.42	752	16.76
Valencia and Folha Murcha	9,592.07	732	238 ~~230~~	27.6 ~~26.4~~	2.10	971	20.14	1.99	921	19.11
Natal...................................	2,585.87	539	244 ~~237~~	40.4 ~~28.5~~	1.45	728	3.76	1.18	589	3.04
Subtotal............................	**29,452.08**	**648**	**260 ~~255~~**	**24.3 ~~23.6~~**	**1.75**	**859**	**51.49**	**1.69**	**831**	**49.78**
SOUTHWEST SECTOR										
Hamlin, Westin and Rubi....	5,643.73	781	298	12.1 ~~11.4~~	2.08	953	11.73	2.06	946	11.64
Other early..........................	1,940.37	481	272	14.9 ~~11.2~~	1.41	745	2.73	1.35	715	2.62
Pera Rio..............................	11,611.05	526	271 ~~259~~	16.7 ~~23.9~~	1.38	743	16.04	1.45	777	16.78
Valencia and Folha Murcha	13,034.33	524	246 ~~221~~	23.9 ~~26.0~~	1.57	833	20.52	1.45	767	18.90
Natal...................................	6,001.87	558	255 ~~219~~	31.1 ~~29.6~~	1.61	834	9.64	1.35	700	8.09
Subtotal........................	**38,231.35**	**566**	**266 ~~249~~**	**20.2 ~~22.4~~**	**1.59**	**822**	**60.66**	**1.52**	**787**	**58.03**

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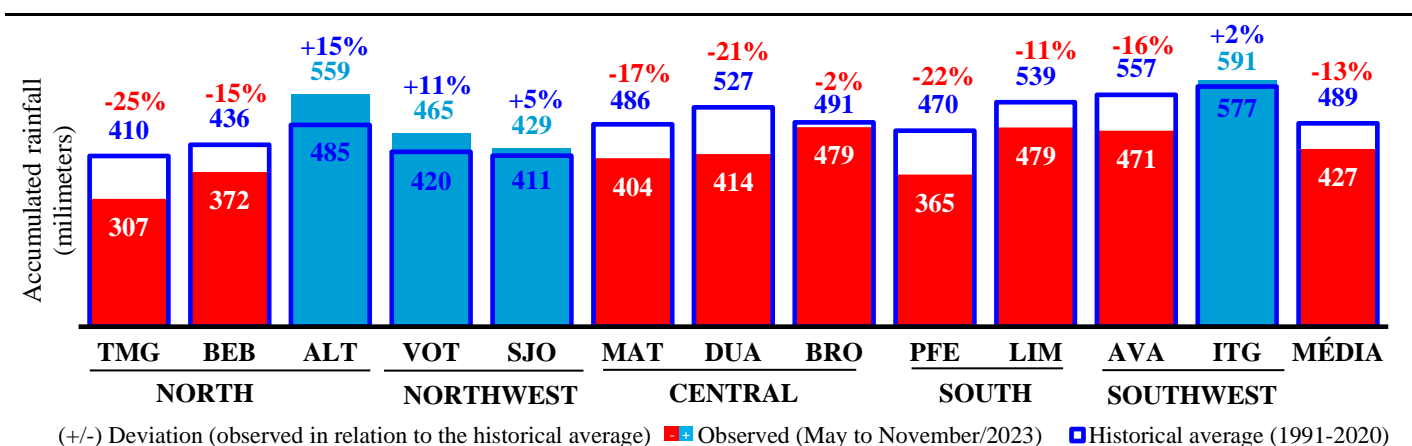## Total forecast production of oranges[1] updated to 307.22 million boxes

The second forecast for the 2023-2024 orange crop in the São Paulo and West-Southwest of Minas Gerais citrus belt, published on December 11, 2023, by Fundecitrus, in cooperation with Markestrat, FEA-RP/USP, and FCAV/Unesp[2], is 307.22 million boxes of 40.8 kg each. Of this total estimated production, approximately 27.60 million boxes are expected to come from the Triângulo Mineiro region.

In this update, the initial projection is reduced by 2.12 million boxes, corresponding to 0.7%. This adjustment reflects the balance considering all varieties. The oranges from early varieties, already harvested almost entirely, benefited from abundant rains at the beginning of the year, resulting in a production exceeding the estimated 2.27 million boxes. Meanwhile, the estimated production of oranges from other varieties (Pera Rio, Valencia, Valencia Folha Murcha and Natal) suffers a reduction of 4.39 million boxes due to the fruits being smaller than expected. The decrease in the harvest is not even more significant because the rate of premature fruit drop from these varieties, except for Natal, is lower than projected, partially offsetting the effect of the decrease in the size of the oranges.

One factor contributing to oranges not reaching their projected sizes is the persistent below-average rainfall, despite its frequent occurrence from January to April this year and the heavy rains since the commencement of the harvests in most of the citrus belt. The precipitation observed in the cumulative period from May to November contradicts weather forecasts that predicted rainfall with positive anomalies for this season due to the El Niño phenomenon. These rainfall forecasts, which were not confirmed, were used in May 2023 as a basis for projecting the size of the fruit. Additionally, the high temperatures over the last three months have favored increased evapotranspiration rates. Variation in fruit size is observed in regions with different severity levels of citrus greening, suggesting that the increased intensity of the disease is also one of the factors affecting the growth of oranges. Another impactful factor is the accelerated pace at which harvesting progresses, leading to a shorter period for fruit development and harvesting many oranges before the rainiest season of the year, when there is greater fruit filling.

Despite harming orange growth, faster harvesting is emerging as a strategy to reduce the fruit drop rate, thus mitigating crop losses. However, it is essential to note that, in the present days, the drop rate has been impacted mainly by citrus greening, remaining above historical levels.

The average accumulated precipitation in the citrus belt from May to November 2023 was 427 millimeters, 13% lower than the climatological normal (1991-2020). In eight of the 12 regions, the accumulated rainfall during this period was below the historical average, totaling 307 millimeters in Triângulo Mineiro (-25%); 372 millimeters in Bebedouro (-15%); 404 millimeters in Matão (-17%); 414 millimeters in Duartina (-21%); 479 millimeters in Brotas (-2%); 365 millimeters in Porto Ferreira (-22%); 479 millimeters in Limeira (-11%) and 471 millimeters in Avaré (-16%). In the four regions with positive deviations, the accumulations were 559 millimeters in Altinópolis (+15%); 465 millimeters in Votuporanga (+11%); 429 millimeters in São José do Rio Preto (+5%) and 591 millimeters in Itapetininga (+2%). The rainfall data was obtained from Climatempo Meteorologia and is shown in Graph 1.

Graph 1 – Accumulated rainfall from May to November 2023
Source: Fundecitrus, according to data from Climatempo Meteorologia

In the current update, considering all varieties, 255 fruits are needed to form a 40.8 kg box, representing an increase of eight fruits compared to the scenario forecast in May. This amount corresponds to oranges weighing 160 grams (5.64 oz), in contrast to the average weight initially projected at 165 grams (5.82 oz). If this projection is confirmed, the fruits will weigh less than the average of the last ten years, which is 163 grams (5.75 oz).

The average fruit size of the Hamlin, Westin and Rubi varieties is 293 fruits per box (139 grams/4.91 oz per fruit), confirming the projection made in the September update. The size of oranges from other early varieties has also been confirmed in comparison to the projection, with 251 fruits per box (163 grams/5.73 oz per fruit). On the other hand, the size of the Pera orange, which had been reduced in the September forecast, is reduced again in this update, from 249 fruits per box (164 grams/5.78 oz per fruit) to 258 fruits per box (158 grams/5.58 oz per fruit). The size of the Valencia and Valencia Folha Murcha varieties goes from 222 fruits per box (184 grams/6.48 oz per fruit) to 233 fruits per box (175 grams/6.18 oz per fruit). The Natal variety goes from a projected 227 fruits per box (180 grams/6.34 oz per fruit) to 244 fruits per box (167 grams/5.90 oz per fruit). The sizes by sector and variety are shown in Table 2.

Table 2 – Average fruit sizes by sector and variety[1]

Group of varieties	Sector (hatched values were presented in September and their respective values updated in December are on the left)					
	North	Northwest	Central	South	Southwest	Total
	(Fruits per box)	(Fruits per box)	(Fruits per box)	(Fruits per box)	(Fruits per box)	(Fruits per box)
Hamlin, Westin and Rubi……….	289	276	290 ~~289~~	303 ~~302~~	298	**293**
Other earlies...............................	246	245 ~~244~~	247	274	272	**251**
Pera Rio......................................	255 ~~242~~	241 ~~242~~	257 ~~248~~	260 ~~255~~	271 ~~259~~	**258 ~~249~~**
Valencia and V. Folha Murcha...	221 ~~214~~	219 ~~229~~	237 ~~226~~	238 ~~230~~	246 ~~221~~	**233 ~~222~~**
Natal...	233 ~~219~~	220 ~~246~~	248 ~~235~~	244 ~~237~~	255 ~~219~~	**233 ~~227~~**
Total...	**248 ~~241~~**	**239 ~~244~~**	**255 ~~247~~**	**260 ~~255~~**	**266 ~~249~~**	**255 ~~247~~**

[1] The precision of the overall average of the citrus belt is higher than that of the sectors, ages or variety groups, due to the larger sample size.

The projected fruit drop rate has been revised from 21.0% to 19.0% on average, considering all varieties. In the distribution of the drop rate between varieties, Hamlin, Westin and Rubi ended up at 10.8% and the other early varieties at 12.1%. Pera Rio reduced from 22.5% to 19.0%; Valencia and Valencia Folha Murcha decreased from 25.5% to 22.0% and Natal rose from 26.5% to 28.9%. The drop rates by sector and variety are shown in Table 3.

Table 3 – Average drop rates by sector and variety[1]

Group of varieties	Sector (hatched values were presented in September and their respective values updated in December are on the left)					
	North	Northwest	Central	South	Southwest	Total
	(percentual)	(percentual)	(percentual)	(percentual)	(percentual)	(percentual)
Hamlin, Westin and Rubi……….	7.2 ~~7.3~~	6.6 ~~7.3~~	9.6 ~~9.8~~	17.5 ~~17.6~~	12.1 ~~11.4~~	**10.8**
Other earlies...............................	8.6 ~~9.0~~	15.2 ~~15.8~~	12.3 ~~13.0~~	16.7 ~~17.0~~	14.9 ~~11.2~~	**12.1 ~~12.0~~**
Pera Rio......................................	15.5 ~~19.5~~	11.5 ~~17.5~~	24.3 ~~25.2~~	21.9 ~~23.6~~	16.7 ~~23.9~~	**19.0 ~~22.5~~**
Valencia and V. Folha Murcha....	19.0 ~~22.9~~	14.1 ~~29.5~~	21.5 ~~26.6~~	27.6 ~~26.4~~	23.9 ~~26.0~~	**22.0 ~~25.5~~**
Natal...	18.3 ~~23.9~~	23.8 ~~28.9~~	31.6 ~~23.1~~	40.4 ~~28.5~~	31.1 ~~29.6~~	**28.9 ~~26.5~~**
Total...	**14.7 ~~17.7~~**	**12.9 ~~20.0~~**	**20.6 ~~21.8~~**	**24.3 ~~23.6~~**	**20.2 ~~22.4~~**	**19.0 ~~21.0~~**

[1] The precision of the overall average of the citrus belt is higher than that of the sectors, ages or variety groups, due to the larger sample size.

Harvest reached 82% of production in mid-November, showing a much faster pace compared to previous years, when it was around 60% around the same time. The harvest of the early varieties, including Hamlin, Westin and Rubi, has already been completed, while the harvest of the other early varieties, including Valencia Americana, Seleta, Pineapple and Alvorada, is almost over, at 97%. The Pera Rio harvest is 94% complete; Valencia and Valencia Folha Murcha, 67%; and Natal, 50%.

The method used for the update is the same adopted in the previous crop season. Information was obtained from the monitoring survey started in May on 1,200 plots that are no longer visited when fruit harvest is complete. Other data used in this study is size of fruit received throughout the crop season by orange juice companies associated to Fundecitrus – Citrosuco, Cutrale and Louis Dreyfus – for industrial processing. Each processing company supplies individual data under confidentiality to the independent consulting firm for the calculation of the average size of processed fruit.

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[1] Hamlin, Westin, Rubi, Valencia Americana, Seleta, Pineapple, Alvorada, Pera Rio, Valencia, Valencia Folha Murcha and Natal.
[2] Department of math and science, FCAV/Unesp Jaboticabal Campus.