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Evaluation of variation in physical and physio-biochemical parameters of *Citrus limon* “Assam lemon” fruits at different stages of development and storage

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SUPPLEMENTARY MATERIAL

Days after fruit set and storage	Length (cm)	Breadth (cm)	Rind thickness (mm)	Albedo (mm)	Flavedo (mm)	LPA (mm)	Pith Diameter (mm)	Color of fruit	Fruit weight (g)	Peel weight (g)	Pulp weight (g)	Pulp : Peel ratio SD	Specific gravity
7 DAF	4.53 ± 0.05a	2.17 ± 0.05a	ND	ND	ND	ND	ND	Green	12.67 ± 0.88a	ND	ND	ND	1.57 ± 0.13d
15 DAF	5.97 ± 0.13b	3.9 ± 0.36b	ND	ND	ND	ND	ND	Green	32.41 ± 1.11b	ND	ND	ND	1.25 ± 0.07c
30 DAF	7.57 ± 0.13c	5.03 ± 0.09c	5.2 ± 0.28g	3.57 ± 0.21c	1.63 ± 0.13g	17.92 ± 0.26a	9.26 ± 0.21e	Green	57.92 ± 1.34c	35.51 ± 2.04a	22.41 ± 0.91a	0.63 ± 0.01a	1.14 ± 0.09b
45 DAF	8.13 ± 0.61d	5.27 ± 0.12cd	5.5 ± 0.08h	4 ± 0.08f	1.5 ± 0.08g	19.37 ± 1.62a	8.46 ± 0.13d	Green	89.09 ± 2.56d	46.09 ± 1.58b	43 ± 1.1b	0.93 ± 0.01b	1.01 ± 0.01a
60 DAF	9.55 ± 0.31e	5.37 ± 0.12d	7 ± 0.29i	6 ± 0.22h	1 ± 0.08f	21.92 ± 1.47b	2.86 ± 0.31a	Green	103.49 ± 1.44e	48.91 ± 2.04bc	54.28 ± 0.72c	1.11 ± 0.01c	0.98 ± 0.04a
90 DAF	9.98 ± 0.14f	6.07 ± 0.05f	5 ± 0.16g	4.27 ± 0.05g	0.73 ± 0.21e	22.48 ± 0.74b	10.74 ± 0.05f	Greenish Yellow	127.32 ± 1.13f	51.16 ± 1.64c	76.16 ± 0.51d	1.49 ± 0.08d	0.97 ± 0.01a
120 DAF	10.22 ± 0.09gh	6.33 ± 0.09h	4.33 ± 0.13f	3.8 ± 0.08f	0.53 ± 0.05d	26.28 ± 0.25de	6.41 ± 0.31c	Yellow	146.92 ± 6.68g	53.17 ± 4.01cd	93.75 ± 2.67e	1.76 ± 0.01e	0.97 ± 0.02a
150 DAF	10.5 ± 0.18h	6.4 ± 0.08h	4 ± 0.22e	3.57 ± 0.13e	0.43 ± 0.09cd	27.98 ± 1.3e	4.04 ± 0.31b	Yellow	179.11 ± 4.71k	60.1 ± 2.86e	119.01 ± 1.86i	1.98 ± 0.01f	1.06 ± 0.02ab
SRT 7 DAS	10.42 ± 0.05fgh	6.18 ± 0.03fgh	3.78 ± 0.04de	3.41 ± 0.05de	0.37 ± 0.01bcd	27.02 ± 0.69de	4.03 ± 0.04b	Yellow	174.28 ± 4.2ijk	59.28 ± 1.34e	115 ± 2.86hi	1.94 ± 0.01f	1.03 ± 0.01a
SRT 15 DAS	10.31 ± 0.04fgh	5.96 ± 0.03f	3.42 ± 0.03c	3.11 ± 0.04c	0.31 ± 0.01abc	26.1 ± 0.31cd	3.98 ± 0.05b	Yellow	169.42 ± 4.06ij	58.14 ± 1.66e	111.28 ± 2.40gh	1.91 ± 0.01f	1.01 ± 0.01a
SRT 21 DAS	10.17 ± 0.02fgh	5.61 ± 0.03e	3.01 ± 0.03b	2.77 ± 0.04b	0.24 ± 0.01ab	24.57 ± 0.41c	3.96 ± 0.04b	Pale Yellow	167.93 ± 2.01hi	58.02 ± 2.86e	109.91 ± 0.71g	1.9 ± 0.08f	0.99 ± 0.01a
SRT 28 DAS	10.02 ± 0.03fg	5.17 ± 0.03cd	2.46 ± 0.04a	2.31 ± 0.08a	0.15 ± 0.04a	22.66 ± 0.53b	3.92 ± 0.12b	Pale Yellow	161.92 ± 3.23h	58.78 ± 0.29de	105.8 ± 1.31f	1.89 ± 0.06f	0.96 ± 0.01a
SCT 7 DAS	10.46 ± 0.02gh	6.32 ± 0.03h	3.97 ± 0.03c	3.56 ± 0.06c	0.41 ± 0.02bcd	27.6 ± 0.56de	4.04 ± 0.11b	Yellow	178.98 ± 1.6k	59.78 ± 0.29e	119.2 ± 1.31i	1.99 ± 0.01f	1.06 ± 0.01ab
SCT 15 DAS	10.39 ± 0.02fgh	6.24 ± 0.03gh	3.87 ± 0.05de	3.49 ± 0.04de	0.38 ± 0.01bcd	27.26 ± 0.34de	4.02 ± 0.08b	Yellow	178.11 ± 3.51k	59.66 ± 1.08e	118.45 ± 2.43i	1.99 ± 0.01f	1.05 ± 0.01ab
SCT 21 DAS	10.31 ± 0.05fgh	6.15 ± 0.03fgh	3.73 ± 0.04de	3.38 ± 0.06de	0.35 ± 0.02bc	26.89 ± 0.29de	3.99 ± 0.23b	Yellow	177.33 ± 4.93k	59.42 ± 1.51e	117.91 ± 3.42i	1.98 ± 0.01f	1.05 ± 0.01ab
SCT 28 DAS	10.21 ± 0.03fgh	6.03 ± 0.02fg	3.61 ± 0.03cd	3.32 ± 0.43d	0.29 ± 0.02abc	26.37 ± 0.25de	3.96 ± 0.1b	Yellow	176.21 ± 5jk	59.06 ± 2.38e	117.15 ± 2.61i	1.98 ± 0.04f	1.03 ± 0.01a

ND: Not Detected; ±: Standard Error; DAF: Day After Fruit Set; SRT: Storage At Room Temperature; SCT: Storage At Cold Temperature (4 °C); DAS: Day After Storage

Days after fruit set and storage	pH	% Juice Content	TSS	Citric Acid (g/ml)	Ascorbic Acid (mg/ml)	TSS/TA	Total Sugar (µg/ml)	Reducing Sugar (µg/ml)
30 DAF	2.12 ± 0.04a	12.16 ± 0.16a	6.9 ± 0.16d	0.06 ± 0.01a	0.26 ± 0.02h	5.75 ± 0.21k	164.92 ± 2.98a	16.19 ± 1.49a
45 DAF	2.25 ± 0.06ab	35.12 ± 1.61b	6.7 ± 0.22cd	0.08 ± 0.01ab	0.21 ± 0.03g	4.19 ± 0.07i	176.45 ± 2.17b	18.24 ± 1.06a
60 DAF	2.4 ± 0.1b	41.24 ± 1.18c	6.7 ± 0.37cd	0.1 ± 0.02bc	0.15 ± 0.02f	3.35 ± 0.11g	194.66 ± 4.19c	21.2 ± 0.94b
90 DAF	2.58 ± 0.05c	45.46 ± 0.94d	6.5 ± 0.29cd	0.16 ± 0.02d	0.12 ± 0.02ef	2.03 ± 0.06c	201.27 ± 3.49d	23.32 ± 1.83b
120 DAF	2.87 ± 0.07d	49.12 ± 1.43ef	6.3 ± 0.29bc	0.19 ± 0.02de	0.11 ± 0.02de	1.66 ± 0.04b	214.19 ± 2.89e	26.28 ± 1.31c
150 DAF	3.12 ± 0.12e	52.16 ± 0.92h	5.6 ± 0.31a	0.24 ± 0.02f	0.08 ± 0.02cd	1.17 ± 0.06a	227.16 ± 4.19f	29.76 ± 1.43d
SRT 7 DAS	3.45 ± 0.02f	51.12 ± 1.55fgh	5.7 ± 0.08a	0.21 ± 0.03ef	0.06 ± 0.01bc	2.71 ± 0.02e	228.18 ± 2.44f	30.17 ± 0.82d
SRT 15 DAS	3.88 ± 0.01h	50.08 ± 0.06efgh	5.7 ± 0.16a	0.17 ± 0.01d	0.05 ± 0.01abc	3.35 ± 0.02g	230.32 ± 1.14fg	32.06 ± 1.16def
SRT 21 DAS	4.18 ± 0.07i	49.68 ± 0.41efg	5.8 ± 0.16a	0.12 ± 0.01c	0.04 ± 0.01ab	4.83 ± 0.02j	231.97 ± 0.81fg	33.19 ± 1.62ef
SRT 28 DAS	4.46 ± 0.21j	48.42 ± 0.82e	5.9 ± 0.16ab	0.07 ± 0.01ab	0.02 ± 0.01a	8.43 ± 0.07l	234.42 ± 1.44g	34.08 ± 1.34f
SCT 7 DAS	3.31 ± 0.06f	52.02 ± 0.72h	5.6 ± 0.16a	0.22 ± 0.01ef	0.07 ± 0.01bc	2.54 ± 0.03d	227.92 ± 0.98f	29.98 ± 0.85d
SCT 15 DAS	3.56 ± 0.09g	51.86 ± 0.56h	5.6 ± 0.08a	0.19 ± 0.02de	0.07 ± 0.01bc	2.95 ± 0.08f	228.98 ± 0.16fg	30.14 ± 0.69d
SCT 21 DAS	3.79 ± 0.06h	51.48 ± 0.82gh	5.7 ± 0.08a	0.16 ± 0.02d	0.06 ± 0.01bc	3.56 ± 0.05h	230.12 ± 1.64fg	30.46 ± 1.15d
SCT 28 DAS	3.97 ± 0.03h	51.02 ± 0.04fgh	5.8 ± 0.08a	0.12 ± 0.01c	0.04 ± 0.01ab	4.83 ± 0.05j	231.17 ± 0.67fg	30.98 ± 0.82de

ND: Not Detected; ±: Standard Error; DAF: Day After Fruit Set; SRT: Storage At Room Temperature; SCT: Storage At Cold Temperature (4 °C); DAS: Day After Storage

Days after fruit set and storage	Carotenoid Content (mg/g)	Chlorophyll Content (µg/g)		
		Chlorophyll a	Chlorophyll b	Total Chlorophyll
7 DAF	2.25 ± 0.01a	1.26 ± 0.08c	2.72 ± 0.19g	3.98 ± 0.21gh
15 DAF	2.35 ± 0.01a	1.42 ± 0.04d	2.77 ± 0.21g	4.19 ± 0.17h
30 DAF	2.47 ± 0.18a	1.62 ± 0.15e	3.35 ± 0.22h	4.97 ± 0.25i
45 DAF	2.51 ± 0.36a	2.32 ± 0.1f	3.9 ± 0.09i	6.22 ± 0.18j
60 DAF	2.53 ± 0.08ab	1.57 ± 0.09e	2.23 ± 0.15f	3.8 ± 0.24g
90 DAF	2.6 ± 0.18abc	1.32 ± 0.09cd	2.12 ± 0.13f	3.44 ± 0.21f
120 DAF	2.65 ± 0.05abcd	0.71 ± 0.05b	1.66 ± 0.1e	2.37 ± 0.15e
150 DAF	2.81 ± 0.15bcde	0.21 ± 0.03a	0.98 ± 0.11d	1.19 ± 0.14d
SRT 7 DAS	2.83 ± 0.02cde	0.18 ± 0.01a	0.85 ± 0.02cd	1.03 ± 0.01cd
SRT 15 DAS	2.86 ± 0.01cde	0.16 ± 0.01a	0.72 ± 0.02bc	0.88 ± 0.02bc
SRT 21 DAS	2.9 ± 0.01cde	0.12 ± 0.01a	0.59 ± 0.01ab	0.71 ± 0.02ab
SRT 28 DAS	2.95 ± 0.01e	0.07 ± 0.01a	0.41 ± 0.01a	0.48 ± 0.01a
SCT 7 DAS	2.82 ± 0.01bcde	0.19 ± 0.01a	0.91 ± 0.02cd	1.1 ± 0.01cd
SCT 15 DAS	2.85 ± 0.01cde	0.17 ± 0.01a	0.85 ± 0.01cd	1.03 ± 0.02cd
SCT 21 DAS	2.88 ± 0.01cde	0.14 ± 0.01a	0.81 ± 0.02bcd	0.95 ± 0.02bcd
SCT 28 DAS	2.92 ± 0.01cde	0.11 ± 0.01a	0.74 ± 0.01bcd	0.85 ± 0.02bc

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Days after fruit and storage	Pectin Content (%)		Equivalent Weight (%)		Methoxy Content (%)		Anhydrounic Acid (%)		Degree of Esterification (%)	
	Peel	Pulp	Peel	Pulp	Peel	Pulp	Peel	Pulp	Peel	Pulp
7 DAF	0.42 ± 0.05a	ND	3.49 ± 0.27bc	ND	0.56 ± 0.14c	ND	7.93 ± 1.16d	ND	39.89 ± 5.01bc	ND
15 DAF	0.96 ± 0.04d	ND	3.76 ± 0.13c	ND	0.5 ± 0.1bc	ND	7.27 ± 0.71cd	ND	41.73 ± 3.87bc	ND
30 DAF	1.36 ± 0.14e	2.17 ± 0.17c	4.5 ± 0.22d	2.73 ± 0.35bc	0.48 ± 0.08bc	0.39 ± 0.11e	6.1 ± 0.65c	8.68 ± 1.37c	44.49 ± 3.3c	25.67 ± 3.23e
45 DAF	2.36 ± 0.17g	3.15 ± 0.26d	5.83 ± 0.67e	3.06 ± 0.54cd	0.37 ± 0.11b	0.29 ± 0.1de	4.78 ± 0.95b	7.39 ± 1.57bc	44.11 ± 4.83c	24.18 ± 2.92d
60 DAF	2.77 ± 0.23h	5.26 ± 0.26e	8.73 ± 0.58g	4.79 ± 0.73e	0.22 ± 0.09a	0.21 ± 0.06cd	3.27 ± 0.67a	4.96 ± 0.88a	38.24 ± 8.93bc	22.02 ± 2.47de
90 DAF	2.44 ± 0.21g	3.06 ± 0.23d	6.85 ± 0.54f	3.49 ± 0.42d	0.21 ± 0.09a	0.17 ± 0.05bc	3.69 ± 0.73a	5.98 ± 0.89ab	31.76 ± 7.62b	15.61 ± 2.35c
120 DAF	1.69 ± 0.16f	2.36 ± 0.24c	3.13 ± 0.23ab	2.11 ± 0.42b	0.17 ± 0.06a	0.15 ± 0.04abc	6.44 ± 0.76c	9.15 ± 1.86c	14.7 ± 3.9a	8.97 ± 0.72b
150 DAF	0.89 ± 0.04d	1.17 ± 0.07b	2.69 ± 0.31a	1.12 ± 0.2a	0.15 ± 0.07a	0.09 ± 0.04ab	7.3 ± 0.53cd	16.19 ± 2.95d	11.15 ± 5.81a	2.88 ± 0.74a
SRT 7 DAS	0.85 ± 0.01cd	1.08 ± 0.02ab	2.69 ± 0.02a	1.14 ± 0.01a	0.14 ± 0.02a	0.09 ± 0.02ab	7.28 ± 0.18cd	15.95 ± 0.2d	10.79 ± 1.63a	2.72 ± 0.54a
SRT 15 DAS	0.76 ± 0.02cd	1.02 ± 0.01ab	2.72 ± 0.02a	1.17 ± 0.02a	0.13 ± 0.02a	0.07 ± 0.01ab	7.21 ± 0.15cd	15.44 ± 0.26d	10.22 ± 1.07a	2.57 ± 0.26a
SRT 21 DAS	0.64 ± 0.02abc	0.93 ± 0.02ab	2.76 ± 0.04a	1.19 ± 0.02a	0.11 ± 0.02a	0.06 ± 0.02ab	7 ± 0.01c	15.13 ± 0.11d	8.92 ± 1.33a	2.26 ± 0.63a
SRT 28 DAS	0.51 ± 0.02ab	0.81 ± 0.02a	2.81 ± 0.05a	1.21 ± 0.02a	0.09 ± 0.02a	0.05 ± 0.02a	6.77 ± 0.25cd	14.83 ± 0.1d	7.48 ± 1.78a	1.92 ± 0.64a
SCT 7 DAS	0.87 ± 0.03cd	1.12 ± 0.02ab	2.71 ± 0.03a	1.13 ± 0.02a	0.15 ± 0.03a	0.09 ± 0.03ab	7.29 ± 0.26cd	16.09 ± 0.04d	11.14 ± 2.11a	2.86 ± 1.16a
SCT 15 DAS	0.82 ± 0.01cd	1.09 ± 0.02ab	2.72 ± 0.01a	1.16 ± 0.02a	0.14 ± 0.02a	0.08 ± 0.02ab	7.27 ± 0.12cd	15.63 ± 0.46d	10.91 ± 1.74a	2.81 ± 0.81a
SCT 21 DAS	0.78 ± 0.01cd	1.03 ± 0.01ab	2.74 ± 0.02a	1.17 ± 0.02a	0.12 ± 0.02a	0.07 ± 0.01ab	7.11 ± 0.08cd	15.47 ± 0.34d	9.57 ± 1.85a	2.69 ± 0.12a
SCT 28 DAS	0.72 ± 0.02bcd	0.95 ± 0.02ab	2.77 ± 0.02a	1.18 ± 0.04a	0.11 ± 0.03a	0.06 ± 0.01ab	6.98 ± 0.15cd	15.27 ± 0.56d	8.9 ± 2.47a	2.22 ± 0.22a

ND: Not Detected; ±: Standard Error; DAF: Day After Fruit Set; SRT: Storage At Room Temperature; SCT: Storage At Cold Temperature (4 °C); DAS: Day After Storage

Nutrient Type	Soil Nutrients	Result	Quantity
Micronutrients	Copper (Cu)	Critical	0.5 - 2 ppm
	Zinc (Zn)	Low	0 - 0.5 ppm
	Boron (B)	Low	0.1 - 1 ppm
	Manganese (Mn)	Low	0 - 2 ppm
	Iron (Fe)	High	> 6 ppm
	Molybdenum (Mo)	Low	0 - 0.1 ppm
	pH	Slightly Alkaline	7.5
Macronutrients	Organic Carbon (C)	Medium Low	0.300 - 0.500%
	Phosphate (PO ₄ ³⁻)	Medium High	56 - 73 kg/ha
	Potassium (K)	Medium	112 - 280 kg/ha
	Ammoniacal Nitrogen (NH ₃ -N)	Low	15 kg/ha
	Nitrate Nitrogen (NO ₃ -N)	Very Low	4 kg/ha

ppm: Parts Per Million; kg/ha: Kilograms Per Hactare