Fruit Quality of New Cold-Hardy *Opuntias* from Northern and High-Elevation Sites in Mexico

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ABSTRACT

Tolerance to freezing weather of about 12°C is the major biological barrier to commercial *Opuntia* fruit production in Texas. Since one of the most severe freezes killed all commercial cactus varieties to ground level in December 1989, three new germplasm collections with potential for increased cold hardiness were obtained at Texas A&M University-Kingsville. In the summer of 1998, these collections were 8-, 7-, and 5-growing-seasons old. Despite a record drought in the spring of 1998, for the first time many clones produced significant quantities of fruit. The fruit of these new clones was analyzed for fruit size, seed content, pH, and sugar content. A yellow-fruited spiny fruit (1402) and a spiny orange-fruited clone (1403) collected at 2200 m elevation near Saltillo, Mexico, had a good balance of yield and fruit quality and deserve further evaluation, especially for use in cold areas. Of the 29 clones in the selection program for survival at 16°C by Lorenzo Martinez Medina, clone 1436 had the greatest potential for production and total soluble solids (TSS). Two clones (1452 and 1458) obtained from a major collection trip in northern Mexico had promise. Clone 1452, a spineless red-fruited clone from a region where 16°C temperatures occurred, had good production of moderate TSS fruit (12.6), while clone 1458 had early production of high TSS (13.5) yellow fruit. Particular attention was paid to the seed content of the fruits because development of low-seedy varieties has been deemed an important priority for first-time consumers. Six new clones with potential for low seediness were identified. Two of these clones, a spineless yellow-fruited clone (1260) from Algeria and a spiny orange-fruited clone from Mexico (1403), had sufficient yield, fruit size, and TSS to have immediate commercial potential. The remaining clones with low seed contents (1391, 1267, 1414, and 1434) either had too small fruit size, too low yield, or too low TSS to be commercially acceptable. However, these latter clones have potential for use as parents in a breeding program.

INTRODUCTION

The major limitation to commercial *Opuntia* fruit production in Texas is the lack of tolerance to record low temperatures of 12°C, such as occurred in 1983 and 1989 (Barrientos et al., 1992; Gregory et al., 1993; Parish and Felker, 1997). For example, all of the 5-year-old commercial cactus fruit varieties at Texas A&M University-Kingsville froze to the ground during the freeze of 1989. Since 1989, significant new *Opuntia* collections have been obtained at high elevations (2200 m) in northern Mexico with potential to resist freezing temperatures. In March 1991, the first cold-tolerant clones were obtained from Ing. Fernando Borrego-Escalente at the Universidad Autonoma Agaria Antonio Narro (Barrientos-Escalente et al., 1990).

In August and October 1991, additional clones were collected at 2,200 m elevation south of Saltillo, Mexico, in a valley (San Antonio de las Alazanas) where potatoes and apples were grown commercially (Barrientos et al., 1992). This area has a rich biodiversity of fruit cacti, with orange, yellow, purple, pink, and red spineless and spiny varieties (Barrientos et al., 1992). In October 1993, with International Arid Lands Funding, A. Nerd from Israel and P. Felker made a collection trip from Saltillo, Mexico north to Juarez, Mexico and west to Casa Grande, Mexico. Because the east side of the Sierra Madres experiences the full severity of the 15-year record-low arctic cold fronts, while the western side of the Sierra Madres is almost frost free, collections were made on the eastern part of the Sierra Madres.

In addition, we were fortunate enough to obtain 29 clones of cold hardy *Opuntias* from Lorenzo Martinez Medina (Martinez, 1968). Using seeds obtained as a by-product of a cactus-pear processing facility (queso de tuna), in June 1961 Lorenzo Martinez Medina obtained 300,000 *Opuntia* seedlings. The seeds came from fruits that were harvested near Saltillo (1500 m) and at Escobedo (about 2000 m) about 20 km south of Saltillo. Only 45 seedlings of the initial 300,000 seedlings survived the record low temperature of 16°C (4°F) that occurred in January 1962. Thirty of these seedlings later produced white fruits of good quality (Martinez, 1968).

As the youngest plants of these recent collections have now been planted for five years at Texas A&M University-Kingsville, and had significant fruit production, this paper compared the fruit quality of these genetic materials for increased cold hardiness.

MATERIALS AND METHODS

Above normal rainfall occurred in 1997, i.e., 909 mm, that provided good soil-moisture levels. This high rainfall continued into 1998 with 12 mm in January, 64 mm in February, and 25 mm in the first half of March. However, the above normal rainfall pattern ended abruptly and only 23 mm of rain occurred from March 17 through the end of July. May and June are normally peak rainfall months in Kingsville and this was the lowest rainfall on record for this period. The period of flowering and fruit maturation from April through the end of July was essentially without rain.

In January 1998, 400 g of 17-5-10 fertilizer was applied near the base of each plant. Given the 1 m by 4 m spacing, this was equivalent to 170 kg N, 50 kg P and 100 kg K per ha. For weed control a mixture of 16 ml l^{-1} glyphosate (RoundupÔ) and 75 g l^{-1} of the simazine formulation Caliper 90 was used.

Because the cactus in the field were obtained from various collection trips, they were of various ages. The oldest cacti were those obtained from Fernando Borrego at the Universidad Autonoma Agraria Antonio Narro and were planted in April 1991 (eight growing seasons). The next cacti collected were obtained from a field trip in October 1991 to San Antonio de las Alazanas and were, thus, seven growing seasons old. The youngest acquisition obtained by Felker and Nerd in northern Mexico, including the Lorenzo Martinez Medina collection, were planted in October 1993 and were, thus, in their fifth growing season. The Lorenzo Martinez Medina collection experienced considerable rotting of cladodes in the winter in the high humidity Gulf of Mexico climate at Kingsville. This rotting was similar to an *Erwinia* soft rot on cactus described elsewhere in this volume by Saad et al. (1999). In the summer, rotting was much less severe because the plants seemed to outgrow the disease. In addition to rotting of the cladodes, many of the clones had a black sooty growth at the joints of the cladodes identified as *Diplodia* spp by R. Barnes of the Texas A&M Plant Diagnostic Laboratory. This is generally thought to be a weak opportunistic secondary problem controlled by sanitation. To assist in control of both these "diseases", in the winter of 1997/1998 a copper sulfate mixture (KocideÔ) was applied monthly.

The fruit pH, sugar, and seed content were measured as described previously (Parish and Felker, 1997). When fruits were available, five fruits were analyzed separately for each clone. The analyses consisted of homogenizing the fruit pulp in a blender, measuring the pH of the homogenate, then filtering the homogenate through a screen to capture the seeds. The seeds were then air dried and weighed. Probably due to the drought, some fruits were smaller than normal, i.e., <70 g, and appeared to have a greater quantity of undeveloped seed. Some of the undeveloped seed did not appear to be retained on the standard screen we used previously. Therefore, screens of various mesh sizes were compared for their ability to capture the seeds. The first two screens were normal "kitchen-type screens" with square openings that were about 1.7 mm on a side (2.4 mm diagonal) and 1.2 mm on a side (1.7 mm diagonal), respectively. The last screen used was a soil screen with 1 mm round holes. As an absolute check on the passage of seeds through different screens, the homogenate was passed through filter paper on a Buchner funnel.

RESULTS AND DISCUSSION

Because the fruit quality of many of the clones in this collection were reported previously (Wang et al. 1997), this paper reports on the fruit quality of clones that were not sufficiently developed to produce fruits in earlier years. It is important to recognize important year-to-year variation in the mean TSS concentration of all the clones. For example, the 24 clones reported in Wang et al.(1997) had a mean TSS of 14.0 in 1996 and 11.8 in 1997. These same 24 clones had a mean TSS of 13.6 in 1998 and, thus, were close to the 1996 levels. It is interesting that 1996 had a rainfall total of 250 mm, 1997 a rainfall total of 909 mm, and the 1998 growing season only 23 mm. Thus, the drought years had the highest mean TSS.

Additional UAAAN clones described by Borrego-Escalante et al., (1990) came into production in 1998 for the first time. These clones included 1377(ANV2), 13.5 TSS and 91 g fruit weight; 1382(ANT2), 12.9 TSS and 112 fruit weight; 1384(ANT4), 14.2 TSS and 108 g fruit weight; 1385(ANTV1), 13.7 TSS and 120 g fruit weight; and 1387(ANTV3), 14.5 TSS and 115 g fruit weight. Clone 1377 was a spineless red fruit, and clones 1382, 1384, 1385, and 1387 had spiny yellow fruit with considerable black sooty lesions of *Diplodia*.

Because development of varieties with smaller and fewer seeds is an important objective to attract first-time consumers of cactus fruit (Caplan, 1995), particular attention was given to the seediness of varieties just beginning to bear fruit. Important progress has been made in the development of seedless varieties by Weiss et al. (1993) who reported parthenocarpic *Opuntia* fruit, and by Parish and Felker (1997) who reported *Opuntia* fruits with seed contents comparable to the Weiss et al. (1993) clones.

The effect of screen size on retention of normal and aborted seed is presented in Table 1. As normal developed seed were about 35 mm in diameter, they were retained on a normal "kitchen" screen with square openings 1.7 mm on a side. However, as the percentage of aborted/undeveloped seed increased with smaller fruits, the passage through the standard screen size increased. In one of the fruit, the percentage by weight of the aborted seed was 35% of the total seed weight. As development of *Opuntia* fruits with a low seed content is a high priority, it would appear useful to screen the fruit homogenate with both a 1.7 mm screen to obtain the normal seed and to rescreen the homogenate with a 1 mm round screen to obtain the weight of aborted seed. It is curious that although these fruits were small, their relatively high TSS content (13.6) and pH (5.9) suggested they were mature. As the seed weights per fruit normally range from 2.1 to 6.4 g fruit^{-1} (Parish and Felker, 1997), these seed weights of 1.5, 0.48, and 0.17 g fruit^{-1} are very low and deserve further investigation in the search for "seedless" *Opuntia* varieties.

Rather than just report seed fruit^{-1}, we have reported seed per gram of pulp to normalize the amount of seeds for different size fruits. While clones such as 1413, 1464, 1454, and 1429 had a low seed pulp^{-1} ratio (<0.04), these clones had such low TSS, i.e., 11.4, 8.8, 9.6, and 9.6, respectively, that they would not be useful fruit cultivars.

The 1998 fruit evaluations found six clones with both low seediness and TSS of 12.5 and above (Table 2). This is in addition to clones 1319, 1321, 1279, and 1282 that we have previously reported (Parish and Felker, 1997) to have low seediness. Clone 1391 from the Antonio Narro collection of Borrego (ANF1) was morphologically similar to the Chilean clones 1319 and 1321 in having elongated narrow pointed cladodes (75 x 25 cm). Clone 1391 had a very low yield as was also the case for the Chilean clone 1321 (Parish and Felker, 1997) and we suspect clone 1391 may be very closely related to the Chilean clones. The yellow-fruit production from clone 1260 was high (not reported in Parish and Felker as it was nonreplicated) and the plant was vigorous with an open erect habit. Clone 1260 deserves more serious investigation as a high yielding, spineless, moderately high-sugar plant with low seeds. Clone 1267 from Algeria is a frost-sensitive species with low yields and small fruits. The large waxy cladodes (70 cm by 60 cm) of this clone with

undulating margins make an ideal ornamental plant for low-frost environments. In contrast to the low frost tolerance of clone 1267, clones 1403, 1414, and 1434 have considerable promise as cold hardy fruit varieties. Clone 1403, with a deep orange colored fruit and high fruit productivity, was obtained at 2,200 m elevation south of Saltillo where freezing weather is common. Clones 1414 and 1434 were from the Lorenzo Martinez Medina collection that survived 16°C as six-month-old seedlings. However, only a very few fruit were produced by clones 1414 and 1434. From an overall perspective of yield, TSS, and low seediness, only clones 1260 and 1403 could be recommended at this time. However, the clones 1391, 1267, 1414, and 1434 should be examined as parents in a breeding program to reduce seediness in cactus fruit.

The 29 clones obtained from Lorenzo Martinez Medina in October 1993 appeared remarkably similar in height, form, color, spine characteristics, fruit external characteristics, and low fruit yield. Only 9 of the 29 clones set fruit in their 5th growing season (Table 3). Furthermore, only small quantities of fruit occurred on those that set fruit. Possibly the presence of considerable rot in the winter reduced the fruit crop. If these varieties were grown in a less humid area, they might have greater fruit productivity. As can be seen in Table 3, most of the accessions produced only several fruit of a size that is too small (80 g) and too low in sugar (TSS = 12.5) to normally be commercially acceptable. As noted above, three of these clones (1414, 1429, 1434) produced fruit with a high proportion of undeveloped/aborted seed and show promise as genetic source of low seediness for cactus pears. If only cold hardiness was the objective, clone 1436 would be the clone of choice as it had more fruit than the other clones, a greater TSS (14.3) and a larger fruit size (109 g).

Because the clones obtained from high-elevation sites above Saltillo, Mexico, were seven growing seasons old, they were large enough to produce substantial fruit. However, the lack of rain from April through the end of June may have negatively impacted fruit quality. Nearly all fruit color/spine combinations were present in this collection (Table 4) with promise for increased cold hardiness. The two spineless pink clones, i.e., 1392 and 1406 (known as rojo pelon), had thin rinds, high yields of fruit, and moderately high sugar. The spiny yellow and orange clones 1402 and 1403 had good sugar levels with large pulp yields and have promise as commercial clones. The fruit of clone 1402, known as "chapeada", had a slight pinkish hue and a distinctive aromatic flavor somewhat resembling bananas. In general, the pulp size and TSS were lower from these clones than other standard clones, such as the spiny orange-fruited clone 1287 with 67 g of pulp and a TSS of 15.3 or the spineless yellow-fruited clone 1277 with 67 g of pulp and TSS of 14.4.

Also included in Table 4 were three clones (1410, 1411, and 1412) obtained from El Gran Tunal in Ojuelos, Mexico, that were provided because they had considerable cold tolerance. The spineless pinkish clone 1410 had a good TSS of 13% and a moderate sized pulp. Clone 1411, a "robusta" type was provided for nopalitos and cattle feed. Clone 1412, known as "charola" bloomed in central Mexico in November and December, and had fruits until March in Mexico. The fruits of the "charola" were small but high in TSS.

The most noteworthy fruit-producing clones obtained in the 1993 collection trip of Nerd and Felker were clones 1442, 1452, and 1458 (Table 5). Clone 1442 had abundant red fruit with good fruit/pulp size of 132/63 g, respectively, and TSS of 13.1. This clone was collected south of Chihuahua city where large eucalyptus were present, indicating a lack of severe frost. In contrast, clone 1452, also with abundant spineless red fruit (132 g fruit, 65 g pulp, TSS 12.6), was collected in Casas Grandes, Mexico, at 1450 m elevation 250 km northwest of Chihuahua city where much colder temperatures occurred. Workers in Casas Grandes fruit orchards stated that temperatures of 16°C occurred at this site. The last exceptional clone from the Nerd and Felker collection trip, 1458, was spineless and produced prolific numbers of yellow fruit of average size (117 g fruit, 51 g pulp, 13.5 TSS and 0.071 seed/pulp ratio). While this clone was collected on the east side of the Sierras 150 km north of Chihuahua city, this clone suffered some tip damage from a freeze of 7°C in 1996/1997. Furthermore, unlike clones from high elevation/cold sites near Saltillo that are among the last to flower and set fruit, this clone is among the first to set flower and fruit in the spring.

There appeared to be a trend for the clones from the high-elevation regions experiencing the most cold to have the latest date of fruit flowering and maturation. Table 6 gives the dates of fruit collection for each of the clones. Because not all five fruits were always available at the first sampling date, it was sometimes necessary to collect on two sampling dates.

On the first sampling date of 16 June, it can be seen that only clones described in previous publications (Gregory et al., 1993) without exceptional cold hardiness were collected (One *O. robusta* type 1411 from Ojuelos, Mexico, was collected). However, none of the clones from the high elevations near Saltillo (Table 4) or of the Lorenzo Martinez Medina cold-hardiness collection (Table 3) or of Fernando Borregos collection (Borrego-Escalante, et al., 1990) were harvested at this time. In the second sampling period, one of the 10 clones near Saltillo was harvested, and none of the Lorenzo Martinez Medina collection were harvested.

On the fourth sampling date (68 July), a mixture of clones harvested listed in Tables 3 and 4, as well as those identified in earlier work, were harvested. The fifth sampling date observed a preponderance of the high-elevation Saltillo clones and the Lorenzo Martinez Medina clones. The last two sampling dates only collected cold hardy clones from the Universidad Autonoma Agraria Antonio Narro (1382, 1388), or Lorenzo Martinez Medina clones (1422, 1423, 1430, 1434), or clones collected at cold sites in the state of Chihuahua (1454, 1464).

Thus, the first harvest date contained no clones from very cold areas, while the last two harvest dates contained exclusively clones from cold-hardy areas. It seems reasonable that clones from areas that experience frequent and late frosts would be more likely to have late-bearing fruit than clones from areas with mild winters without late frosts. As far as we are aware, this is the only empirical relationship between cold hardiness and any other parameter.

Abundant rain the winter before flowering, a mild winter, and heavy NPK fertilization contributed to an initial high fruit load. However, with a complete lack of rain from bud initiation until fruit maturation, some clones either did not fill out completely or many fruits abscised from the parent plant. Especially the yellow and white clones, such as 1390 and 1383, followed this tendency for fruit abscission. In contrast, the fruit of the pinkish (rosa) varieties filled out fully, had thin rinds, good firmness, and did not abscise. These pinkish clones appear especially suited to production under limited water availability. The fruit characteristics of the four pink clones presented in Table 6 are remarkably similar in all regards except for TSS. However, as clone 1406 was located in a different field experiment than clones 1379, 1389, and 1392, these TSS differences could be due to field-position effects. However, all four of these "rosa pelon" clones appeared to have excellent agronomic and fruit characteristics. Unlike clones such as 1277 and 1287 that produced abundant fruit at earlier ages, these clones only set significant fruit six to eight years after establishment.

CONCLUSIONS

The 1998 fruit evaluations found six clones with both low seediness and TSS of 12.5 and above. One of these low-seedy clones, 1391 from the Antonio Narro collection of Borrego (ANF1), was similar morphologically and in very low yield to the Chilean clones 1319 and 1321, and we suspect clone 1391 may be very closely related to the Chilean clones. Clone 1260 was vigorous, erect, had high production of yellow fruit and deserves serious investigation as a high-yielding, spineless, moderately high-sugar plant with low seeds. The low-seedy clone 1403 had a deep-orange-colored fruit, had high fruit productivity and was obtained at 2,200 m elevation south of Saltillo where freezing weather is common. From an overall perspective of yield, TSS, and low seediness, only clones 1260 and 1403 could be recommended at this time. However, the other low-seedy clones 391, 1267, 1414, and 1434 should be examined as parents in a breeding program to reduce seediness in cactus fruit.

Among the clones from the high-elevation areas near Saltillo, Mexico, the spiny yellow and orange clones 1402 and 1403 had good sugar levels with large pulp yields and have promise as

commercial clones. The fruit of clone 1402, known as "chapeada", had a slight pinkish hue and a distinctive aromatic flavor somewhat resembling bananas.

Noteworthy among the fruit clones obtained in the 1993 collection trip into northern Mexico were clones 1452 and 1458. Clone 1452 had abundant spineless red fruit that was collected at 1450 m elevation 250 km northwest of Chihuahua city where fruit-orchard workers stated that temperatures of 16°C occurred. Clone 1458 was spineless and produced prolific numbers of yellow fruit of average size.

Four spineless pink fruit clones produced significant quantities of fruit with a thin rind and a firm pulp that did not dehisce in this drought year. The highest sugar producing clone, 1287, has been a consistently good clone for more than 10 years. When this clone was more than 2 m tall and 7 years old, it did not suffer damage from a 7°C freeze, thus deserves attention, as well as the newer clones.

There was a tendency for clones from the coldest regions to have the latest harvest date.

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Table 1. Effect of Screen Size on Retention of Seed from Small Fruits of *Opuntia* spp Accession 1434 with Considerable Aborted Seed

Fruit Weight	Pulp Weight	TSS	pH	Seed Retention on Various Screen Sizes		
				1.7 mm Opening	1.2 mm Opening	1.0 mm Opening
85 g	29 g	13.2	5.8	1.51 g (100%)	0.11 g (7%)	0.0035 g (0.23%)
62 g	19 g	13.6	6.0	0.48 g (100%)	0.03 g (6.3%)	0.0051 g (1.1%)
67 g	17 g	13.4	5.9	0.17 g (100%)	0.06 g (35%)	0.0089 g (5.2%)

The seed weight in the first column was from seed retained on largest screen. The seed weight in the second column was from seed that passed the first screen but was retained on second screen. The seed weight in the last column was from seed that passed the second screen but was retained on filter paper.

Table 2. Emerging *Opuntia* Clones with Potential for Low Fruit Seediness

Accession	Fruit Weight (g)	Seed/Fruit (g)	Seed/Pulp (%)	TSS
1321 standard	121	1.59	0.033	15.0
1391	194	2.16	0.034	13.6
1260	147	2.92	0.034	13.6
1267	91	1.81	0.039	14.1
1403	131	2.28	0.039	13.1

1414	87	0.35	0.010	12.5
1434	71	0.72	0.010	13.4

Table 3. Fruit Characteristics of Lorenzo Martinez Medina Cold-Tolerant Clones

Accession (n)	**Fruit Weight (g)**	**Pulp Weight (g)**	**Seed Weight (g)**	**TSS**	**pH**	**Seed/PulpRatio**
1414 (2)	87	36	0.35	12.5	6.1	0.010
1415 (5)	98	38	2.1	12.8	6.1	0.058
1417 (4)	85	25	1.9	11.4	5.9	0.073
1419 (5)	89	36	2.8	12.8	5.8	0.079
1429 (2)	57	19	0.79	12.6	6.3	0.033
1430 (1)	122	48	2.44	15.0	5.8	0.051
1431 (1)	104	51	2.2	12.4	6.0	0.042
1434 (3)	71	20	0.72	13.4	5.9	0.036
1436 (6)	109	46	2.3	14.3	5.9	0.048

All these plants were spiny and had yellow/green fruit.
(n) indicates the number of fruit analyzed. All available fruit, up to 5, were analyzed.
TSS = total soluble solids.

Table 4. Characteristics of *Opuntia* Fruit Clones from High Elevations near Saltillo, Mexico

				TSS	**pH**	

Color,Spines*	Weight (g)	Weight (g)	Weight (g)			Ratio
1392 pink (-)	136	66	3.8	11.9	6.1	0.059
1393 white (-)	105	33	2.8	13.2	5.9	0.085
1396 white (+)	122	48	3.7	14.3	6.1	0.077
1397 red (+)	81	19	1.7	14.6	5.8	0.088
1398 orange (+)	145	39	2.1	12.8	5.7	0.053
1401 white (+)	117	36	2.6	13.2	6.0	0.073
1402 yellow (+)	176	59	4.1	13.3	6.2	0.061
1403 orange (+)	131	56	2.3	13.0	6.0	0.044
1404 purple (+)	91	17	2.1	11.8	5.9	0.12
1405 red (+)	134	47	3.44	12.6	6.0	0.074
1406 pink (-)	135	68	4.4	12.9	6.1	0.064
1407 red (+)	190	72	5.9	13.4	6.1	0.072
1410 red (-)	96	50	3.5	13.0	6.1	0.073
1411 red (-)	127	57	4.0	11.7	5.9	0.066
1412 red (+)	84	32	2.5	13.1	5.4	0.077

* (+) designates with spines; (-) designates without spines

Table 5. Fruit Characteristics of *Opuntia* Collected by Nerd and Felker in the State f Chihuahua

Accession (n)	Fruit Weight (g)	Pulp Weight (g)	Seed Weight (g)	TSS	pH	Seed/PulpRatio
1442 (6)	138	67	3.5	12.8	6.0	0.051
1452 (9)	137	65	3.5	12.5	6.2	0.054
1458 (11)	125	52	3.6	13.2	6.1	0.064
1444 (5)	108	37	3.0	11.8	6.1	0.083
1454 (3)	81	33	1.5	9.6	4.5	0.028
1459 (5)	128	60	3.1	12.7	6.1	0.051
1461 (6)	52	12	1.1	12.6	5.7	0.091
1464 (3)	89	35	1.3	11.6	6.0	0.037

(n) indicates the number of fruit analyzed.

Table 6. First Date of *Opuntia* Fruit Ripening at Kingsville, Texas, in 1998

16 June:
1277, 1282, 1288, 1294, 1300, 1301, 1411.

25-27 June:
1118, 1253, 1270, 1278, 1279, 1281, 1282, 1288, 1294, 1298, 1301, 1319, 1320, 1377, 1378, 1379, 1380, 1383, 1390, 1404, 1410, 1458, 1459.

30-1 July:
1253, 1271, 1274, 1279, 1283, 1287, 1297, 1319, 1376, 1383, 1389, 1392, 1406, 1458.

6-8 July:
1258, 1265, 1267, 1274, 1275, 1285, 1288, 1292, 1296, 1299, 1384, 1386, 1387, 1392, 1396, 1397, 1401, 1402, 1405, 1406, 1410, 1417, 1419, 1422, 1444, 1452, 1458, 1461.

13-14 July:
1234, 1253, 1255, 1287, 1292, 1382, 1386, 1388, 1393, 1402, 1405. 1407, 1408, 1415, 1417, 1419, 1429, 1431, 1436, 1442, 1444, 1452, 1459.

29 July:
1240, 1285, 1387, 1391, 1403, 1412, 1436, 1464.

7 August:
1382, 1388, 1422, 1423, 1430, 1454, 1464.

14 August:
1434

Table 7. Comparison of Nondehiscing Pinkish "Rosa-pelon" Varieties

Accession	Fruit Weight (g)	Pulp Weight (g)	Seed/PulpRatio	TSS (%)
1392	136	66	0.06	11.9
1379	144	55	0.08	13.6
1389	133	66	0.06	13.6
1406	135	68	0.06	12.9

Clone 1392 was obtained from a farmer at a lower elevation than Saltillo on the road to Monterrey. Clone 1406 was obtained at Escobedo, 500 m greater elevation than Saltillo. Clones 1379 and 1389 were Universidad Agraria Autonoma Antonio Narro clones ANV4 and ANTV5, respectively.