

Evaluation of Pioneer and Celebration plum cultivars under El-Khatatba region condition

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ABSTRACT

Two plum cultivars (Pioneer and Celebration) grown in a private commercial orchard at (El-Khatatba region) were evaluated under the Egyptian climatic conditions during two successive seasons of 2013 and 2014. Evaluation parameters included vegetative and flowering measurement, fruiting attributes, yield and fruit quality. The obtained data showed that Pioneer was superior to Celebration in total vegetative buds and opening percentage of flower buds. Pioneer was earlier in the date of vegetative bud opening, beginning of flowering period and full bloom date than Celebration in the two seasons of the study. Pioneer was superior in initial and final fruit set % compared to Celebration cultivar. Days from full bloom till maturity ranged from 70 to 86 days for studied cultivars. Since Pioneer were also earlier in fruit maturity than Celebration. The yield in kilograms / tree was higher for Pioneer than Celebration cultivars. No significant differences in fruit, flesh and pit weights between Pioneer and Celebration cultivars were found. Fruit firmness was ranged between the two cultivars (3.56 - 4.31 Lb/inch²). Brix ° ranged from 12.95 to 14.25 % for the two tested cultivars since acidity ranged from 0.91 to 1.00 %. Celebration plum cultivar revealed the highest Brix °/acid ratios as compared with Pioneer plum cultivar. It could be concluded that Pioneer plum cultivar are considered as promising cultivar under Egypt conditions due to their precocity, high initial fruit set, high yield and early fruit ripening and good fruit quality properties, with the exception of firmness.

Keywords: Plum cultivars, Evaluation, Flower bud, Fruit set, Yield, Fruit quality.

INTRODUCTION

Plum, (*Prunus salicina* L.) is one of the deciduous fruit trees cultivated in Egypt. The total area planted with plum reached about 2753 feddan and annual production about 13616 ton. According to the Statistics, ministry of agriculture Egypt, (2013). In Egypt, it is known that some of the cultivated areas of plums are planted by Beauty, Hollowed and Santa Rosa.

Okinawa rootstock (*P. persica*) 150 chilling unit, used a source for breeding in adaptation a low-chill peach cultivar, resistance to *Meloidgyne incognita*, *M. javanica* and tolerant to *M. floridensis*. The cultivar Okinawa is originated from Japan and it was taken to the United States in 1953 where it was selected as rootstock from seeds. Its chilling requirement is low and it is very exigent with the spring temperatures. In this respect, Wongtanet and Boonprakob (2012) evaluate the influence of rootstocks on growth of some cultivars and found that 'Okinawa' had the highest growth and good scion performance as compared to other rootstocks.

Pioneer is an early red-skinned plum variety. Skin is bright red and the flesh a pale yellow color. Pioneer was bred by Infuriate in South Africa released in 1995. Its harvest & Availability in Late November from South Africa.

The aim of the study was to evaluate the two plum cultivars Pioneer and Celebration on the Okinawa rootstock, in terms of the vegetative, flower and fruit characteristics, yield and fruit quality.

MATERIALS AND METHODS

The present study was carried out to evaluate the newly plum cultivars namely Pioneer and Celebration. Trees were four years old budded on Okinawa rootstock. Planted at 4 × 6 m under drip irrigation in a private farm located in El-Khatatba region, Egypt. Each cultivar (treatment) was represented by five trees, each tree was served as one replicate, uniform in size and vigour as

possible. Evaluation was carried out at two successive seasons in 2013 and 2014 and the following measurements were recorded:

Flowering and vegetative measurements: percentage of flower and vegetative buds and opening percentage of flower bud were calculated on each selected two types of shoots; shoots (> 20 cm) and spurs (2-10 cm) per each tree for each cultivar, and the dates of vegetative bud opening, the beginning of flowering, full bloom date was recorded when 80 % of flowers was opened and appeared and flowering duration (days) were recorded.

Fruiting attributes: initial fruit set percentage (21 days after petal fall), final fruit set percentage, number of days from full bloom till maturity, dates of beginning of maturity, harvest period and yield per tree (number of fruits and weight in kg) were recorded.

Fruit quality characteristics: at the harvest time of each cultivar. A sample of 10 fruits from each selected two types of shoots; shoots (> 20 cm) and spurs (2-10 cm) per tree were taken to determined physical properties including fruit, flesh and pit weights (gm), fruit firmness (inch / Lb²), fruit shape index (length / diameter in cm) and chemical properties including Brix ° in juice were measured by using hand refractometer and total acidity % as a maleic acid as (Juice acidity) according to the Official Methods of Analysis (A.O.A.C 1990). Brix °: acidity was calculated as ratio between Brix ° and acidity %.

The experimental design was randomized complete block with 5 replication. Data were statistically analyses according to the method of Duncan (1955).

RESULTS AND DISCUSSION

Flowering and vegetative measurements:

Both percentage of flower buds and flower bud opening and percentage of vegetative buds on the two

different types, shoots and spurs of the two plum cultivars in the two seasons 2013 and 2014 are presented in Table (1) Celebration cultivar revealed the highest flower bud percentage followed by Pioneer cultivar, this results was agreement with Fathy (2014) who found Celebration on Okinawa had a significant highest percentage of floral buds. Whereas, Pioneer cultivar gave the highest percentage of flower bud opening followed by Celebration cultivar in the two seasons of the study, Wongtanent and Boonprakob (2012) observed that the scion cultivars Tropic beauty, TX2293-3, TXW149-1 showed the highest number of flower buds (17 buds) on Okinawa rootstock compared to other studied Rootstocks. With respect to percentage of vegetative bud, Pioneer cultivar gave the highest percentage followed by Celebration cultivar. Maklad (2005) reported that the percentage of vegetative buds of four apricot varieties varied from year to year and showed no significant differences in the last season. On the other hand, spurs always gave the highest percentage of flower bud and flower bud opening. On the contrary, shoots gave the highest percentage followed by spurs in vegetative bud percentage in the both seasons of the study. The interaction between the cultivars and the type of shoots showed that, both cultivars under study gave the highest percentage of flower bud on spurs but on the contrary about the percentage of vegetative buds on the shoots for the two

cultivars. On the other hand, Pioneer cultivar gave the highest percentage of flower bud opening on spurs followed by the other interactions just in the first season. In this concern many factors have been shown to shift the balance between vegetative growth and flower initiation, but in most cases are with rootstocks (Luckwill, 1970 c.f. Eissa, *et al.* 2001).

Dates of vegetative bud opening, flowering period, full bloom date and flowering duration in (days) of the two plum cultivars in the two seasons 2013 and 2014 are presented in Table (2). In this respect, the data revealed that Pioneer cultivar was earlier in the date of vegetative bud opening, beginning of flowering period and full bloom date than Celebration cultivar in the two seasons of the study. Similarly, Fathy (2014) reported that, vegetative buds of Pioneer was earlier in opening than Celebration about (5 - 16 days) and Okinawa rootstock was the earlier than the other nemaguard rootstock. Also, Pioneer cultivar was earlier than Celebration in starting flowering on and reaching the full bloom in the two year of her study. Furthermore, Durner (1991) and Beckman *et al.* (1992) found differences in bloom date by different rootstock. On the contrary Seif (2000) and Rom (2001) found that Rootstocks affect flowering date.

In general, flowering duration of the two cultivars under study were ranged between 34 - 36 days in the two tested seasons.

Table (1): Percentage of flower buds, flower bud opening and percentage of vegetative buds on the two different types (shoots and spurs) of Pioneer and Celebration plum cultivars in 2013 and 2014 seasons

	Percentage of flower buds			Percentage of flower buds opening			Percentage of vegetative buds		
	Shoot	Spur	Mean	Shoot	Spur	Mean	Shoot	Spur	Mean
Season 2013									
Pioneer	33.51 b	70.26 a	51.88B	67.36 b	100.0 a	83.68A	66.49 a	29.74 b	48.11A
Celebration	36.37 b	90.00 a	63.18A	42.45 c	75.00 b	58.72B	63.63 a	10.00 c	36.81B
Mean	34.94 B	80.13A		54.90B	87.50A		65.06A	19.87B	
Season 2014									
Pioneer	27.06 b	75.00 a	51.03B	76.63 b	90.00 a	83.31A	72.94 a	25.00 b	48.97A
Celebration	27.33 b	92.80 a	60.06A	62.98 c	80.00ab	71.49B	72.67 a	7.20 c	39.93B
Mean	27.19B	83.90A		69.80B	85.00A		72.80A	16.10B	

Mean separation within columns or rows by Duncan *s'* multiple range test , 5 % level .

Table (2) Dates of vegetative bud opening, flowering period, full bloom date and flowering duration of Pioneer and Celebration plum cultivars in 2013 and 2014 seasons

	* Dates of vegetative bud opening	Flowering period	Full bloom date	Flowering duration
Season 2013				
Pioneer	Feb.25	Feb.18 - Mar.24	Mar.2	34
Celebration	Mar.12	Mar.5 - Apr.8	Mar.26	34
Season 2014				
Pioneer	Feb.28	Feb.24 - Apr.1	Mar.15	36
Celebration	Mar.10	Mar.4 - Apr.7	Mar.24	34

* Dates of vegetative buds opening were determined when buds showed the first sign of opening (bud burst).

Fruiting attributes:

Initial data from Table (3) presented the final fruit set percentage, days from full bloom till maturity, dates of beginning of maturity and harvest period the data showed that, the highest percentage of both initial and final fruit set percentages were recorded in Pioneer cultivar (75.70 %, 69.10 % and 8.16 %, 7.75 %)

followed by Celebration cultivar, where most of flowers were dropped and this may be attributed to juvenility status of this cultivar. Generally, the number of days from full bloom till fruit maturity differed from one cultivar to the other and from one year to the other for the same cultivar. The number of days were 68 and 70 days for Celebration cultivar in 2013 and 2014 seasons.

While, the high number of days from full bloom till maturity was 86 day for Pioneer cultivar during the first season. As for the dates of fruit maturity, Pioneer cultivar was very early in maturity date (during the last

week of May) followed by Celebration cultivar it still to the first week of June. The harvest period differed between different cultivars in different seasons and ranged 5 and 9 days.

Table (3): Initial and final fruit set percentage, days from full bloom till maturity, dates of fruit maturity and harvest period of pioneer and celebration plum cultivars in 2013 and 2014 seasons.

	Percentage of initial fruit set	Percentage of final fruit set	Days from full bloom till maturity	Dates of beginning of maturity	Harvest period (days)
Season 2013					
Pioneer	75.70 A	8.16 A	86	May 27	8
Celebration	48.00 B	3.87 B	68	June 2	5
Season 2014					
Pioneer	69.10 A	7.75 A	77	May 31	9
Celebration	38.75 B	4.08 A	70	June 2	5

The number of fruits and the yield in kg per tree are presented in **Table (4)**. In the first season, the average number of fruits per tree was (239 and 398) and yield in Kg was (14.93 and 26.49 kg) were recorded with Pioneer cultivars during 2013 and 2014 seasons, respectively. The lowest yield as number of fruits and weight were obtained by Celebration cultivars in the same seasons of the study.

Table (4): Yield and number of fruit per tree of pioneer and celebration plum cultivars in 2013 and 2014 seasons.

	Tree yield in Kg		number of fruit per tree	
	2013	2014	2013	2014
Pioneer	14.63 A	26.49 A	239 A	398 A
Celebration	3.52 B	6.37 B	60 B	95 B

Fruit quality characteristics:

Table (5) showed the differences in fruit flesh weight and pit weight on shoots and spurs of Pioneer and Celebration plum cultivars. No significant differences in fruit flesh weight and pit weight between Pioneer and Celebration cultivars in the two seasons of the study.

As for the types of shoots, the obtained data presented that spurs recorded the highest value of fruit and flesh weights in two seasons followed by the shoots, which gave the highest value of pit weight from the fruits of the both cultivars.

The interaction between cultivars and types of shoots showed that, Celebration cultivar gave the greatest value of fruit and flesh weights on spurs without significant differences with Pioneer cultivar on both spurs in 2013 season and on spurs & shoots in 2014 seasons. On the contrary, pit weight recorded the highest value on the two type of shoots of Celebration cultivar & on shoots of Pioneer cultivar in the first season and recorded the highest value on the two type of shoots of Pioneer cultivar & on shoots of Celebration cultivar in the second season without any significant differences between them.

Fruit firmness and fruit shape index on the different types of shoots (shoots and spurs) of the two plum cultivars are presented in Table (6). Since, fruit firmness of the two cultivars ranged between (3.56 - 4.31 Lb/inch²) in the two seasons. In this respect Nasr.,

et al., (2013) who found in pioneer plum cultivar, the fruit firmness was ranged about 4.4 - 4.8 Lb/inch² after 7 days of shelf life at (20 ± 2°C). Regarding the response due to the types of shoots, significant differences were observed between shoots and spurs in fruit firmness during 2013 and 2014 seasons' spurs which gave the highest value of fruit firmness compared to the shoots. The interaction between cultivars and types of shoots was significant in the most cases, Celebration cultivar gave the highest value of fruit firmness on the two type of shoots without significant differences with Pioneer cultivar. From the data of Table (6) it could be noticed that no significant differences between Pioneer and Celebration cultivars with respect fruit shape index especially in the first season. Generally the two cultivars fruits tended to the global shape. As for the types of shoots, there is no significant differences in the values of fruit shape index were showed between the shoots and spurs especially in the first season. The interaction between cultivars and types of shoots showed that, always Pioneer cultivar exhibited the highest value of fruit shape index on spurs and shoots in the two seasons without any significant differences between Celebration on the shoot except in the first season.

Data in Table (7) show the brix °, acidity percentage and brix°/ acidity ratio in fruits on the two different types of shoots (shoots and spurs) of the two plum cultivars in 2013 and 2014 seasons. In general the brix ° values of these cultivars were ranged between 12.95 % and 14.25 %. Slight significant differences could be noticed among all tested cultivars during two tested seasons. As for the types of shoots, no significant differences were noticed in brix° values between the two types of shoots especially in the second season. The interaction between cultivars and types of shoots showed that, the highest value of brix° was noticed with Celebration cultivar on spurs and shoots without any significant differences between Pioneer cultivar on spurs in the two seasons of the study.

Table (5): Fruit flesh weight and pit weight of fruits on the two different types of shoots (shoots and spurs) of pioneer and celebration plum cultivars in 2013 and 2014 seasons

	Fruit weight(g)			Flesh weight(g)			Pit weight(g)		
	Shoot	Spur	Mean	Shoot	Spur	Mean	Shoot	Spur	Mean
Season 2013									
Pioneer	59.61bc	62.87ab	61.24A	58.66bc	62.14ab	60.40A	0.95 a	0.73 b	0.84 A
Celebration	51.66c	67.25 a	59.45A	50.77 c	66.38 a	58.57A	0.89 a	0.87 a	0.88 A
Mean	55.63 B	65.06 A		54.71 B	64.26 A		0.92 A	0.80 B	
Season 2014									
Pioneer	63.74ab	69.43ab	66.58A	62.89ab	68.52 a	65.70A	0.85ab	0.88 a	0.86 A
Celebration	62.32 b	72.19 a	67.25A	61.39 b	71.35 a	66.37A	0.93 a	0.84 b	0.88 A
Mean	63.03 B	70.81A		62.14 B	69.93 A		0.89 A	0.86 A	

Mean separation within columns or rows by Duncan s' multiple range test , 5 % level .

Table 6. Fruit firmness and fruit shape index of fruits on the two different types of shoots (shoots and spurs) of pioneer and celebration plum cultivars in 2013 and 2014 seasons.

	Fruit firmness (Lb/inch ²)			Fruit shape index (L/D)		
	Shoot	Spur	Mean	Shoot	Spur	Mean
Season 2013						
Pioneer	3.67 b	3.78 ab	3.72 B	0.90a	0.92a	0.91A
Celebration	4.02 a	4.60 a	4.31 A	0.87a	0.86b	0.86A
Mean	3.84 B	4.19 A		0.88A	0.89A	
Season 2014						
Pioneer	3.48 b	3.65 ab	3.56 B	0.91ab	1.03a	0.97A
Celebration	3.75 ab	4.56 a	4.15 A	0.88b	0.87b	0.87B
Mean	3.61 B	4.10 A		0.89B	0.95A	

Mean separation within columns or rows by Duncan s' multiple range test , 5 % level .

In the two seasons of the study, acidity ranged between (0.91 % – 1.00 %) for Pioneer and

Celebration cultivars without any significant differences between them. The highest acidity was found in the fruits which on the shoots in the two seasons, the interaction between cultivars and types of shoots in the acidity percentage showed that, there were no significant differences between the two types of shoots in the two cultivars except Pioneer cultivar on spurs gave the lowest value in the first season.

Brix ° / acid ratio varied from cultivar to another and from season to season ranged between 13.21 and 15.29 ratio during the two seasons of the study. Celebration cultivar was significantly higher in this ratio than Pioneer in 2014 season. Fruits on spurs gave the highest value followed by the fruits on shoots. The interaction between cultivars and types of shoots showed that, there were non-significant differences between the two cultivars in brix ° / acid ratio on the spurs types during the two seasons of the study and just Celebration cultivar on the shoots (in 2014 season).

Table (7): Brix°, acidity percentage and brix°/acidity ratio of fruits on the two different types of shoots (shoots and spurs) of pioneer and celebration plum cultivars in 2013 and 2014 seasons.

	Shoot	Brix°			Acidity percentage			Brix°/acid ratio		
		Spur	Mean	Shoot	Spur	Mean	Shoot	Spur	Mean	
Season 2013										
Pioneer	12.29 b	13.62ab	12.95B	1.00 a	0.83 b	0.91A	12.29 c	16.40 a	14.34A	
Celebration	13.92ab	14.59 a	14.25A	0.98 a	0.89ab	0.93A	14.20 b	16.39 a	15.29A	
Mean	13.10 B	14.10 A		0.99 A	0.86B		13.24 B	16.36 A		
Season 2014										
Pioneer	12.98 b	13.58ab	13.28B	1.02 a	0.99 a	1.00A	12.72 b	13.71ab	13.21 B	
Celebration	13.82ab	14.26 a	14.04A	1.00 a	0.85ab	0.92A	13.82ab	16.77 a	15.29A	
Mean	13.40 A	13.92 A		1.01 A	0.92 B		13.27 B	15.24 A		

Mean separation within columns or rows by Duncan s' multiple range test , 5 % level .

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تقييم أصناف البرقوق البيونير والسليبريشن تحت ظروف منطقة الخطاطبة

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أجريت هذه الدراسة خلال المواسم ٢٠١٣, ٢٠١٤ لتقييم صنفين من البرقوق هما بيونير وسليبريشن مطعومه على أصل الأوكيناوا في مزرعة خاصة بمنطقة الخطاطبة. حيث تم تقييم الصنفين من حيث الصفات الخضريّة والزهرية والإثمار وصفات الجودة الطبيعيّة والكيميائيّة للثمار والمحصول (عدد الثمار لكل شجرة - المحصول بالكيلوجرام/ شجرة). وأظهرت النتائج المتحصل عليها الآتي: سجل صنف البيونير أعلى نسبة من تفتح البراعم الزهرية والبراعم الخضريّة وكان أكثر تبيكراً في ميعاد بداية الإزهار والإثمار الكامل. مقارنة بالصنف السليبريشن. كذا نسبة العقد الأولي والنهائي والمحصول كانت عالية في صنف البيونير وكذلك كان مبكراً في ميعاد الجمع مقارنة بالصنف السليبريشن. تراوح عدد الايام من الازهار الكامل حتى اكتمال نمو الثمرة ما بين ٧٠-٨٦ يوم للصنفين تحت الدراسة. وكذلك أعطى صنف البيونير أطول فترة للجمع خلال موسمي الدراسة. علاوة على ذلك لم يكن هناك فرق واضح في وزن الثمرة واللحم والبذرة وتراوحت صلابة الثمار ما بين ٣.٥٦ - ٤.٣١ رطل / بوصة^٢ في الصنفين موضع الدراسة. تراوحت نسبة المواد الصلبة الذائبة الكلية ما بين ١٢.٩٥ - ١٤.٢٥ % ونسبة الحموضة ما بين ٠.٩١ % - ١.٠٠ % للصنفين محل الدراسة وأعطى صنف السليبريشن أعلى نسبة من المواد الصلبة الذائبة والحموضة الكلية مقارنة بصنف البيونير. وبناءً لما سبق فإنه يمكن التوصية بأن صنف البرقوق البيونير من الأصناف الواعدة تحت الظروف المصريّة وذلك لتبيكيره وزيادة نسبة العقد والمحصول وتبيكير النضج والصفات الجيدة للثمار باستثناء صلابة الثمرة.