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Evaluation and Registration of Introduced Date Palm (*Phoenix dactylifera* L.) Varieties in Afar Region, Ethiopia

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Abstract: Date Palm (*Phoenix dactylifera* L.) is anciently most known cultivated fruit trees. The fruit composed of very nutritive minerals like potassium, calcium, iron, chlorine, phosphorus and magnesium. The tree tolerates relatively harsh climatic and soil conditions under which no other crop may give reasonable returns. In Ethiopia, date palm cultivated and/or wildly grown crop in Afar, Dire Dawa, Somali, Gambella and Benishangul Gumuz regions. However, the yield of local cultivars was too low to meet the sharply increasing demand. Thus, the research has been conducted to evaluate and register the best performing, desirable yield and quality of introduced improved varieties. Fourteen (14) tissue cultured introduced materials from England and Israel were planted at 10 meters spacing between rows and plants over three locations viz. Werer Agricultural Research Center (WARC), Asaiyta and Afambo. Two varieties (Barhee and Medjool) early fruiting type, were individually evaluated out of 12 varieties on the basis of fruit yield for two years at WARC, while vegetative parameters were taken from the rest locations. The study result revealed that, Barhee and Medjool are superior to the local date palm genotypes. Barhee (158.79 kg/tree/year) was superior to Medjool variety (72.16 kg/tree/year) in fruits yield per tree. In conclusion, Barhee and Medjool profitably and sustainability yielding varieties to low land areas of the Afar regions and similar agroecolgy.

Keywords: Date Palm, Clusters, FAO, Barhee, Medjool, Bunches

1. Introduction

Date palm is considered as the most ancient cultivated fruit tree known to have close relationship with the different major religions of the world [1]. It is largely produced in the hot arid regions of South West Asia and North Africa. The major producers of date palm include Egypt, Iran, Saudi Arabia, Pakistan, Iraq, Algeria, UAE, Oman, Sudan, Libya, Tunisia, Morocco, Mauritania and USA [2]. World production is about 8.17 million metric tons [3]. Date palm produces fruit (dates) which may be dry, semi-dry or soft in texture. The fruit composed of more than 65% sugars (candy like) with several minerals including potassium, calcium, iron, chlorine, phosphorus, magnesium [4]. Date palm tolerates relatively harsh climatic and soil conditions under which no other crop may give reasonable returns.

In Ethiopia, the date palm is well known as a cultivated and/or wild grown crop in Afar, Dire Dawa, Somali, Gambela, Benishangul Gumuz regions of Ethiopia [5]. In Afar region date palm cultivation is by far the most important one. A number of date trees are grown in the Afar region following Awash River banks, where high concentration is found in the lower Awash area. Residents of the Afar communities produce date palm as a major food and cash crop exclusively depending on local cultivars. This helps them to settle and live permanently on one area rather than moving in search of grass and water (personal communication). Informal surveys conducted in afar region so far showed that the productivity of the local cultivars are very low as compared to the standard cultivars known in the world. Some local date palm cultivars in Ethiopia yields 26 to 45 kg fruit per tree per year [6].

According to FAO [1] report the demand for date fruits is steadily growing in international markets as well as local

markets as it can be seen from the amount of fruits imported in recent years. In local market the demand reaches maximum prices during the months of 'Ramadan', the major fasting season of Muslims. Currently, date fruit production in the country is limited and it is not satisfying the demand. As a result, Ethiopia imported 2011 Mt of date in the year 2013 [7]. Regardless of the suitable climatic conditions for the profitable production of date palm in the country, the contribution of the crop to the national economy is almost nil. The attempts so far made by Werer Agricultural Research Center (WARC) includes collection of the available date palm cultivars from Afar region and eastern parts of Ethiopia. In a recent year, few improved tissue cultured date palm varieties were introduced from Israel and England with FAO (Food and Agricultural Organization) collaboration. Therefore, research has been conducted to evaluate the introduced improved varieties to identify the best performing variety with desirable yield and quality for the agro ecology.

2. Materials and Methods

2.1. Description of the Study Area

The experiments were conducted at Werer Agricultural Research Center in horticultural experimental site and at Assayta and Afambo districts on agro-pastorals farm. The experimental locations characterized by very long hot and dry seasons with erratic rainfall (Table 1).

Table 1. *Characteristics of experimental locations.*

Location	Characteristics					
	Latitude	Longitude	Altitude (masl)	Rainfall (mm)	Temperature (mean °C)	Soil type
Werer	9°60' N	40° 9' E	740	560	34	Alluvial
Afambo	11°28' N	41°41' E	404	Xx	xx	xx
Asaiyta	11°34' N	41°26' E	300	Xx	xx	xx

NB: xx- data are not available

2.2. Field Experiment

Two (02) males for pollen sources and twelve females (12) for fruit yield) totally, fourteen (14) tissues cultured commercial date palm varieties were introduced from England and Israel, by WARC in collaboration with FAO in 2009. The introduced materials were planted at three locations *viz.* WARC, Asaiyta and Afambo in Afar region. Two varieties (Barhee and Medjool) were early fruiting type and individually evaluated out of 10 fruit yielding varieties. The trees were planted with 10 meters spacing between rows as well as plants. The soil type of the field was vertisol and irrigated by furrow irrigation with fifteen days' interval and other agronomic managements were applied uniformly. Varieties were evaluated for total fruit yields for two years at WARC. Number of fruits per clusters and bunches and weight of fruits per bunch were recorded following harvesting.

2.3. Statistical Analysis

Analysis of independent two sample t-test and correlation were carried out by using SAS software, version 9.0 (SAS Institute Inc., 2002). Mean comparison was computed by comparing of the mean of one sample with the mean of another sample to test significant difference between the two varieties at 95% of confidence interval.

3. Results and Discussion

3.1. Yield Performance of Registered Varieties Barhee and Medjool

The performance of an average fruit yield and yield related traits of Barhee variety was compared to the performance of Medjool variety based on sample size of each varieties were N = 26 (Table 2). An independent samples T-test for average number of bunches per plant, clusters per bunch and date fruits per cluster revealed that, Barhee variety had significantly higher average number of bunches per plant (M = 18.42, SD = 7.03) than variety Medjool (M = 13.77, SD = 2.64), (t (31.90) = 3.16, $p < 0.0001$). Similarly, variety Barhee had significantly higher average number of clusters per bunch (M = 1680.58, SD = 706.83) than variety Medjool (M = 704.19, SD = 2.64), (t (35.20) = 6.40, $p < 0.0001$). Contrarily, variety Barhee had significantly lower average number of date fruits per cluster (M = 8.81, SD = 3.47) than variety Medjool (M = 12.33, SD = 7.75), (t (34.60) = -2.11, $p < 0.04$). An independent samples T-test for average fruits yield per plant, bunch and cluster revealed that, Barhee variety had significantly higher average fruits yield per plant (M = 158.79, SD = 153.52) than variety Medjool (M = 72.16, SD = 29.23), (t (26.80) = 2.83, $p < 0.01$). Similarly, variety Barhee had significantly higher average date fruits yield per bunch (M = 7.66, SD = 4.75) than variety Medjool (M = 5.16, SD = 1.59), (t (30.50) = 2.54, $p < 0.02$). Inversely, variety Barhee had significantly lower average fruits yield per clusters (M = 107.74, SD = 42.61) than variety Medjool (M = 298.54, SD = 207.63), (t (27.10) = -4.59, $p < .0001$).

In general, variety Barhee had advantage of average fruits yield per bunch and plant over variety Medjool by 86.63 and 2.50 kg, respectively. Inversely, variety Medjool had advantage of average fruits number and yield per cluster over variety Barhee by 3.52 and 190.80 g, respectively. This indicated that Medjool variety fruits per cluster are thicker/dense than Barhee, due to genetic variation exist among them. It was also reported by Omar and El-Abd [8] genetic makeup ultimately affects fruit retention after fertilization in addition to pollen viability, germination percentage. However, the yield of Medjool variety was

inferior due to Barhee had high number of bunches per plant and clusters per bunch 4.65 and 976.39, respectively.

Table 2. *Average fruit yield and yield related traits of Barhee and Medjool date palm varieties average over 26 sample at WARC in 2013/14 and 2014/15 cropping seasons.*

Variety	Statics	Parameters					
		ANBPP	ANCPB	ANFPC	AFYPP (kg)	AFYPB (Kg)	AFYPC (g)
Barhee	Mean	18.42 a	1680.58 a	8.81 b	158.79 a	7.66 a	107.74 b
	Minimum	11.00	1064.00	3.60	29.40	2.10	41.30
	Maximum	41.00	4634.00	15.00	705.20	18.00	200.70
	STD	7.03	706.83	3.47	153.52	4.75	42.61
	SE	1.38	138.62	0.68	30.11	0.93	8.36
Medjool	Mean	13.77 b	704.19 b	12.33 a	72.16 b	5.16 b	298.54 a
	Minimum	10.00	138.00	5.00	22.40	1.60	56.00
	Maximum	18.00	1305.00	34.00	126.00	8.30	661.00
	STD	2.64	326.30	7.75	29.23	1.59	207.63
	SE	0.52	63.99	1.52	5.73	0.31	40.72
Diff (1-2)	Mean	4.65 **	976.39 **	-3.52 *	86.63 **	2.50 *	-190.80 **
	STD	5.31	550.49	6.01	110.51	3.54	149.87
	SE	1.47	152.68	1.67	30.65	0.98	41.57
Method		UNEQ	UNEQ	UNEQ	UNEQ	UNEQ	UNEQ
DF		31.90	35.20	34.60	26.80	30.50	27.10
t Value		3.16	6.40	-2.11	2.83	2.54	-4.59
P-Value		0.0001	<.0001	0.04	0.01	0.02	<.0001

Means followed by different letter within the same column are significantly different at 95% confidence interval, ANBPP = average number of bunches per plant, ANCPB = average number of clusters per bunch, ANFPC = average number of fruits per cluster, AFYPP = average fruit yield per plant, AFYPB = average fruit yield per bunch and AFYPC = average fruit yield per cluster

3.2. Yield Performance of Variety Barhee in 2013/14 and 2014/15 Cropping Season

The performance of Barhee variety in 2013/14 was compared to the performance of 2014/15 cropping season based on sample size of N = 29 and N = 26, respectively (Table 3). An independent samples T-test for average number of bunches per plant, clusters per bunch and fruits per cluster revealed that Barhee variety had significantly produced higher average number of bunches per plant (M = 18.42, SD = 7.03) and average number of clusters per bunch (M = 1680.58, SD = 706.83) in 2014/15 than 2013/14 cropping season (M = 3.83, SD = 3.49), (t (35.70) = -9.59, $p < 0.0001$) and (M = 64.20, SD = 17.79), (t (25.00) = -11.66, $p < 0.0001$), respectively. Similarly, Barhee variety had also significantly produced higher average fruits yield per plant (M = 158.79, SD = 153.52) in 2014/15 than 2013/14 cropping season (M = 32.57, SD = 32.17), (t (27.00) = -4.11, $p < 0.0003$). On another hand, average fruits number and yield per clusters had significantly produced more in 2013/14 cropping season (M = 16.68, SD = 3.80) and (M = 148.54, SD = 32.44), than 2014/15 cropping season (t (53.00) = 7.99, $p < 0.0001$) and (t (53.00) = 4.02, p = 0.0002), respectively. Both tests methods indicated that there was a lack of evidence for a significant difference of variety Barhee between the two cropping seasons for average fruits yield per bunches (t (53) = 0.60 and p = 0.5533 for the pooled test and t (40.5) = 0.58 and p = 0.5640 for the Satterthwaite test).

Generally, Barhee had more average number of bunches per plant (14.60), average number of clusters per bunch (1616.00) and average fruits yield per plant (126.20 kg) in 2014/15 than 2013/14 cropping season. This might be due to the increment in age of the tree increases more bunches to certain limits of age, which will increase yield and yield components. Study by Baloch *et al.* [9] under different categories by farm size and age of the tree in Pakistan indicated that increase in age increases fruits yield in date palm, where higher yield per tree observed in range of 10-20 years aging. Inversely, Barhee had less produced average number of fruits per cluster (7.87) and average fruits yield per cluster (40.80 kg) in 2014/15 than 2013/14 cropping season. This showed that as the load of bunch increased over date palm tree, its loss the ability of fruit filling as a result some fruit become abort from cluster so as, average fruit per cluster become reduced.

In the case of Barhee tested over two years showed that, as the average number of bunches per plant and average number of clusters per bunch increases over successive year, average fruit yield per plant also increased but, average number of fruits per cluster and average fruits yield per cluster become reduced. Study by Alikhani-Koupaei et al [10] revealed that, alternate bearing nature of date fruits and depletion of chemical elements plays a great role in alternate bearing [11].

Table 3. *Average fruit yield and yield related traits of Barhee variety in 2013/14 and 2014/15 cropping season at WARC.*

Year	Statics	Parameters					
		ANBPP	ANCPB	ANFPC	AFYPP (Kg)	AFYPB (Kg)	AFYPC (g)
2013/14	Mean	3.83 b	64.20 b	16.68 a	32.57 b	8.28	148.54 a
	Minimum	1.00	28.00	9.00	3.00	3.00	77.07
	Maximum	12.00	120.00	25.00	132.00	18.00	206.00

Year	Statics	Parameters					
		ANBPP	ANCPB	ANFPC	AFYPP (Kg)	AFYPB (Kg)	AFYPC (g)
	STD	3.49	17.79	3.80	32.17	2.90	32.44
	SE	0.65	3.30	0.71	5.97	0.54	6.02
2014/15	Mean	18.42 a	1680.58 a	8.81 b	158.79 a	7.66	107.74 b
	Minimum	11.00	1064.00	3.60	29.40	2.10	41.30
	Maximum	41.00	4634.00	15.00	705.20	18.00	200.70
	STD	7.03	706.83	3.47	153.52	4.75	42.61
	SE	1.38	138.62	0.68	30.11	0.93	8.36
Diff (1-2)	Mean	-14.60 **	-1616.00 **	7.87 **	-126.20 **	0.63	40.80 **
	STD	5.45	485.63	3.65	108.00	3.88	37.58
	SE	1.47	131.16	0.99	29.17	1.05	10.15
Method		UNEQ	UNEQ	E-VAR	UNEQ		E-VAR
DF		35.70	25.00	53.00	27.00	40.50	53.00
t Value		-9.59	-11.66	7.99	-4.11		4.02
P-Value		<.0001	<.0001	<.0001	0.0003	NS	0.0002

Means followed by different letter within the same column are significantly different at 95% confidence interval, ANBPP = average number of bunches per plant, ANCPB = average number of clusters per bunch, ANFPC = average number of fruits per cluster, AFYPP = average fruit yield per plant, AFYPB = average fruit yield per bunch and AFYPC = average fruit yield per cluster

3.3. Yield Performance of Variety Medjool in 2013/14 and 2014/15 Cropping Season

The performance of variety Medjool in 2013/14 was compared to the performance of 2014/15 cropping season based on sample size of N = 29 and N = 26, respectively (Table 4). An independent samples T-test for average number of bunches per plant and clusters per bunch revealed that the variety Medjool had significantly higher average number of bunches per plant (M = 13.77, SD = 13.77), average number of clusters per bunch (M = 704.19, SD = 326.30) and average fruits yield per cluster (M = 298.54, SD = 207.63) in 2014/15 than 2013/14 cropping season (M = 7.76, SD = 5.40), (t (41.60) = -5.32, $p < 0.0001$), (M = 81.02, SD = 38.81), (t (25.60) = -9.68, $p < 0.0001$) and, (M = 104.86, SD = 55.86), (t (28.20) = -4.61, $p < 0.0001$), respectively.

Table 4. *Average fruit yield and yield related traits of Medjool variety in 2013/14 and 2014/15 cropping season at WARC.*

Year	Statics	Parameters					
		ANBPP	ANCPB	ANFPC	AFYPP (Kg)	AFYPB (Kg)	AFYPC (g)
2013/14	Mean	7.76 b	81.02 b	9.05	88.17	25.44	104.86 b
	Minimum	1.00	24.25	1.60	2.00	1.00	26.90
	Maximum	25.00	189.33	32.00	502.00	502.00	272.10
	STD	5.40	38.81	6.26	106.14	91.80	55.86
	SE	1.00	7.21	1.16	19.71	17.05	10.37
2014/15	Mean	13.77 a	704.19 a	12.33	72.16	5.16	298.54 a
	Minimum	10.00	138.00	5.00	22.40	1.60	56.00
	Maximum	18.00	1305.00	34.00	126.00	8.30	661.00
	STD	13.77	326.30	7.75	29.23	1.59	207.63
	SE	0.52	63.99	1.52	5.73	0.31	40.72
Diff (1-2)	Mean	-6.01 **	-623.20 **	-3.28	16.02	20.27	-193.70 **
	STD	4.33	225.87	7.00	79.72	66.73	148.27
	SE	1.17	61.00	1.89	21.53	18.02	40.04
Method		UNEQ	UNEQ	E-VAR	UNEQ	UNEQ	UNEQ
DF		41.60	25.60	53.00	32.70	28.00	28.20
t Value		-5.32	-9.68	0.74	0.78	1.19	-4.61
P-Value		<.0001	<.0001	0.09	0.44	0.24	<.0001

Means followed by different letter within the same column are significantly different at 95% confidence interval, ANBPP = average number of bunches per plant, ANCPB = average number of clusters per bunch, ANFPC = average number of fruits per cluster, AFYPP = average fruit yield per plant, AFYPB = average fruit yield per bunch and AFYPC = average fruit yield per cluster

Both test methods indicated that there was a lack of evidence for a significant difference of variety Medjool between the two cropping seasons for average number of fruits per cluster (t (53)= -1.73 and p = 0.0889 for the pooled test and t (48.1) = -1.71 and p = 0.0932 for the Satterthwaite test), average fruit yield per plant (t (53)= 0.74 and p = 0.4602 for the pooled test and t (32.7) = 0.78 and p = 0.4408 for the Satterthwaite test) and average fruit yield per bunches (t (53)= 1.12 and p = 0.2657 for the pooled test and t (28) = 1.19 and p = 0.2444 for the Satterthwaite test).

Moreof, average number of bunches per plant (6.01), average number of clusters per bunch (623.20) and average fruits yield per cluster (193.70 kg) of Medjool was high in 2014/15 than 2013/14 cropping season. This showed that similar trend as Barhee variety performed, where increases in year showed increment in yield and yield components. However, as compared with Barhee variety which showed increment in yield from 32.57 kg/tree to 158.79 kg/tree, in respective of 2013/14 to

2014/15, Medjool variety showed insignificant differences over years. This indicated that as Medjool variety is less sensitive to alternate bearing than Barhee.

3.4. Quality Traits of the Two Registered Varieties Barhee and Medjool

The performance of fruit quality traits of Barhee was compared with Medjool variety based on sample size of each variety were N = 30 (Table 5). An independent samples T-test for date width, weight, pulp thickness and weight revealed that, Barhee had significantly higher date width (M = 2.80, SD = 0.14) than variety Medjool (M = 1.02, SD = 0.07), (t (43.90) = 3.48, p < 0.001), date weight (M = 2.95, SD = 0.55) than variety Medjool (M = 2.67, SD = 0..24), (t (39.90) = 2.54, p < 0.02), pulp thickness (M = 0.65, SD = 0.57) than variety Medjool (M = 0.44, SD = 0.07), (t (29.80) = 2.01, p =0.05) and pulp weight (M = 2.11, SD = 0.53) than variety Medjool (M = 1.86, SD = 0.24), (t (40.60) = 2.26, p < 0.03). Contrarily, Barhee had significantly lower average date length (M = 2.80, SD = 0.13) than variety Medjool (M = 2.89, SD = 0.11), (t (58.00) = -3.03, p < 0.001).

In general, Barhee had higher date width, date weight, pulp thickness and pulp weight than variety Medjool by 9.8%, 10.49%, 47.73% and 13.44%, respectively. Inversely, Medjool had longer date length than variety Barhee by 38.94%.

Table 5. *Fruit quality traits of Barhee and Medjool date palm varieties average over 30 sample at WARC in 2013/14 and 2014/15 cropping seasons.*

Variety	Statics	Parameters								
		DL	DWI	DWE	SL	SWI	SWE	PT	PWE	TSS
Barhee	N	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
	Minimum	2.55	0.85	2.10	0.90	0.30	0.60	0.20	1.20	46.00
	Maximum	3.00	1.35	4.20	2.05	0.70	1.20	3.15	3.20	49.00
	Mean	2.80 b	1.12 a	2.95 a	1.74	0.43	0.81	0.65 a	2.11 a	47.78
	STD	0.13	0.14	0.55	0.23	0.10	0.13	0.57	0.53	0.98
	LCL Mean	2.75	1.07	2.75	1.65	0.39	0.76	0.44	1.91	47.42
	UCL Mean	2.84	1.17	3.16	1.82	0.46	0.86	0.86	2.30	48.15
	SE	0.02	0.02	0.10	0.04	0.02	0.02	0.10	0.10	0.18
Medjool	N	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
	Minimum	2.67	0.88	2.22	1.38	0.35	0.60	0.35	1.35	45.00
	Maximum	3.07	1.20	3.20	2.02	0.63	0.95	0.60	2.45	49.00
	Mean	2.89 a	1.02 b	2.67 b	1.78	0.46	0.79	0.44 b	1.86 b	47.33
	STD	0.11	0.07	0.24	0.13	0.06	0.08	0.07	0.24	1.06
	LCL Mean	2.85	1.00	2.58	1.73	0.44	0.76	0.41	1.77	46.94
	UCL Mean	2.93	1.05	2.77	1.83	0.48	0.82	0.46	1.95	47.73
	SE	0.02	0.01	0.04	0.02	0.01	0.02	0.01	0.04	0.19
Diff (1-2)	Mean	-0.09**	0.10**	0.28*	-0.05	-0.04	0.02	0.21*	0.24*	0.45
	STD	0.12	0.11	0.43	0.19	0.08	0.11	0.41	0.42	1.02
	SE	0.03	0.03	0.11	0.05	0.02	0.03	0.10	0.11	0.26
Method		E-VAR	UN-EQ	UN-EQ	UN-EQ	UN-EQ	UN-EQ	UN-EQ	UN-EQ	E-VAR
DF		58.00	43.90	39.90	46.90	49.70	49.00	29.80	40.60	58.00
t-value		-3.03	3.48	2.54	-0.96	-1.64	0.75	2.01	2.26	1.71
P-Value		0.00	0.00	0.02	0.34	0.11	0.46	0.05	0.03	0.09

Means followed by different letter within the same column are significantly different at 95% confidence interval, DL= date length (mm), DWI= date width (mm), DWE= date weight (g), SL= seed length (mm), SWI= seed width (mm), SWE= seed weight (g), PT= pulp thickness (mm), PWE= pulp weight (g) and TSS= total soluble solid (°Brix)

3.5. Correlation of Yield and Yield Related Traits

Average fruit yield per plant was positively and significantly correlated with average fruits yield per bunch (r=0.36**), date width (r=0.39**), date weight (r=35**) and pulp weight (r=0.35**) as (Table 6). Average weight of fruit per cluster was negatively and significantly correlated with average number of clusters per bunch. Similar work was reported by Bedjaoui, and Benbouza [12]. This showed that as the number of clusters per bunch increases the photo-assimilate trans-located among fruits per cluster might be limited, then the weight of average fruits per cluster will be decreased.

Table 6. *Pearsons' Correlation of yield with yield related traits.*

	ANCPB	ANFPC	AFYPP	AFYPB	AWFPC	DL	DWI	DWE	SL	SWI	SWE	PT	PWE	TSS
ANBPP	0.42**	-0.03	0.87**	0.59**	-0.10	0.02	0.47**	0.38**	-0.12	-0.07	0.11	0.29*	0.44**	0.24
ANCPB	1.00	-0.26	0.51**	0.54**	-0.44**	-0.23	0.23	0.20	-0.09	-0.25	-0.01	0.14	0.19	0.02
ANFPC		1.00	-0.08	-0.13	0.24	0.23	-0.26	-0.06	-0.08	0.04	-0.10	0.08	0.01	-0.06
AFYPP			1.00	0.86**	-0.16	0.10	0.39**	0.35**	0.04	-0.15	0.17	0.14	0.35**	0.25
AFYPB				1.00	-0.22	0.06	0.23	0.20	0.13	-0.10	0.24	0.10	0.18	0.21
AWFPC					1.00	0.25	-0.22	-0.08	-0.07	0.16	-0.04	-0.12	0.01	0.05
DL						1.00	0.15	0.29*	0.49**	0.03	0.17	0.03	0.12	0.02
DWI							1.00	0.68**	-0.03	0.09	-0.04	0.28	0.66**	0.14
DWE								1.00	0.19	-0.14	0.10	0.36**	0.88**	0.25

	ANCPB	ANFPC	AFYPP	AFYPB	AWFPC	DL	DWI	DWE	SL	SWI	SWE	PT	PWE	TSS
SL									1.00	-0.01	0.41**	-0.11	-0.18	-0.01
SWI										1.00	-0.01	-0.01	-0.07	-0.20
SWE											1.00	0.07	-0.18	0.16
PT												1.00	0.45**	0.09
PWE													1.00	0.21

*and ** = indicate significant and highly significant difference at P < 0.05 and 0.01, respectively, ANBPP = average number of bunches per plant, ANCPB = average number of clusters per bunch, ANFPC = average number of fruits per cluster, AFYPP = average fruit yield per plant, AFYPB = average fruit yield per bunch, AFYPC = average fruit yield per cluster, DL= date length (mm), DWI= date width (mm), DWE= date weight (g), SL= seed length (mm), SWI= seed width (mm), SWE= seed weight (g), PT= pulp thickness (mm), PWE= pulp weight (g) and TSS= total soluble solid (ºBrix).

3.6. Variety Maintenance and Distribution

Tree and offshoots of Barhee and Medjool varieties are under maintenance at WARC horticultural field. Planting material multiplications of the varieties were underway through their off shoots multiplication. To keep true to types offshoots are very essential. However, offshoots are produced in a limited number for a certain period in the life time of a young date palm tree. Its sprouting also depends on the genetic makeup of the cultivar and environmental factors. The number of offshoots produced by an individual date palm tree highly variable and varies from one cultivar to another. Another discouraging offshoot propagation is slow in survival rate, laborious, time-consuming, and expensive and easily contamination by disease-causing pathogens and insects. Therefore, modern propagation means of date palm tissue culture should be started in the country especially for potential local genotypes which have limited offshoot numbers.

4. Conclusions

The result of this study showed that released varieties Barhee and Medjool are superior to the local date palm genotypes in terms of fruit weight per bunch and average pulp weight, average fruit weight and offshoot production potential. The result also showed that Barhee variety was superior to Medjool variety in fruit yield whereas, Medjool has better offshoot advantage (data not included). In conclusion, the newly released varieties Barhee and Medjool could be cultivated profitably and sustainability in the low land areas of the Afar regional state and other similar agroecolgy. Indeed, there should be an urgent action to multiply planting materials by tissue culture to satisfy the emerging demand.

Conflicts of Interest

The authors declare that they have no competing interests.

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