

Effect of some male date palms on yield and fruit quality of Barhee cultivar

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Abstract

This study was conducted during 2017 & 2018 seasons in order to study the effect of five pollinators of male date palm (grown in Al-Saf region – Giza Governorate) on the yield and fruit quality of Barhee cv. cultivated in Al-Behira Governorate. Five different date palm types were chosen to evaluate which male could be recommended to use as a pollinator for Barhee date palm cv. Four male types namely Fard, Dairy, Ghanamy, Sabad produced from tissue culture and the fifth male was Sewi satellite seedling which grown in farm (uses male as local pollinator) all males were grown in Egypt. Number of spathe/ palm; spathe weight, length & width; pollen tube growth; average of strand length as well as pollen grains germination % were determined for each male. Moreover, pollen grains from each male palm types were used as a pollinator to evaluate their effect on fruit set and fruit quality of cv. Barhee date palm. Data showed that both Sabad and Ghanamy male types were superior in their morphological characters as compared with other male type which showed the lowest values of morphological characters. On the other hand, there were great differences in pollen grains tube growth. Moreover, the results clearly indicated that Ghanamy and Dairy pollen grains recorded the highest fruit set percentage. While Fard produced the highest fruit weight (g) length, diameter, flesh weight, flesh % and bunch weight (kg). Data also revealed that dates that were picked from bunches pollinated with Dairy and Fard pollen had the highest total soluble solids (T.S.S.) value, total sugar, reducing and non-reducing sugar.

Key words: date palm male, fruit quality, yield, pollen grains, Barhee cv.

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Introduction

In Egypt, seedling males are used to rather indiscriminately. However, these seedling males are usually variable and differ greatly in their growth vigor, spathe characteristics and pollen quality artificial pollination is considered to be the most important factor affecting fruit set and yield (Khushk, *et al.*, 2009). The main target for many researchers in Egypt is improving the yield and fruit quality of date palm. This aim could be achieved through improving fruit set and fruit retention, as well as fruit quality. Barhee date palm is one of the most important cultivars of dates. While, the successful orchard management practices are directed toward obtaining a suitable yield with good fruit quality. One of the best tools for date palm reproductive potential studies is a good choice of pollen grains which have cross compatibility with female flowers to improve the yield and fruit quality. Several investigators mentioned that both productivity and quality of date palm were affected by source of pollen grains (Hussein *et al.*, 1999; Aly, 2001; Helail and Hassan, 2001; El-Kosary and Soliman, 2003; Al- Muhtaseb and Ghnain, 2006; Khamis *et al.*, 2010 and Omaima *et al.*, 2015).

The objective of this study was to further evaluation of the effect of using different pollen sources Ghanamy, Fard, Dairy, Sabad compared with Sewi satellite seedling. All males

were grown in Egypt and their pollen grains whorl on fruit setting, yield and fruit characteristics of Barhee date palm.

Materials and methods

This study was carried out during 2017 and 2018 growing seasons on 18 years old Barhee date Palm grown on sandy soil in a private orchard located at El-Khatatba region Behira Governorate, Egypt to study the effect of some pollen grain sources on palm fruiting and quality. The selected palms produced throughout tissue culture technique and palms were chosen healthy, nearly uniform in size and vigor as possible and subjected to the same cultural practices commonly adopted in the orchard. The leaf/bunch ratio was adjusted to be 8:1 in both seasons. The mature male spathes were cut off from one palm tree of the four male cultivars namely Ghanamy, Fard, Dairy and Sabad (produced throughout tissue culture technique) grown in private orchard located at El-safe region Giza Governorate, Egypt, and the fifth male was Sewi (an individual Sewi satellite seedling as suggested by Mason,1927) grown in Egypt. The pollen grain tube growth in each visible area under the optical microscope Nikon Ecllips 90i, using 400 magnifications. During the observation, a pollen grain was considered germinated when the pollen tube length was equal to or greater than the diameter of the pollen grain (Mason, 1927).

The male spathes were collected once spathe cracking and strands were separated individually and dried at room temperature to avoid high moisture. Pollination treatments were done by hand dusting. Pollinated spathes were immediately covered with paper bags to protect them from any foreign pollen grains and were released from the bags after 30 days from pollination time; this period was enough to complete fruit setting. Fifteen female palms were selected and divided into 5 treatments in three replicates (each of one palm) and arranged in randomized complete block design. The morphological properties of the male types were measured i.e. spathe number, spathe length, spathe width, stand number and stand length. Fruit set and fruit retention percentage were calculated after one month of pollination and just before harvest, respectively. The number of fruit set was recorded and then fruit set percentage was calculated according to El-Mkhtoun (1981). All bunches were harvested at full color (Khalal stage) in 15 and 25 September during 2017 and 2018 seasons, respectively. Fruit physical properties i.e. fruit weight & diameter, seed weight and flesh percentage. were estimated Chemical characteristics such as total soluble solids (TSS) was determined by hand refractometer, total acidity, total soluble sugars, reducing sugars, non-reducing sugars and fruit moisture content which were determined according to the methods of A.O.A.C. (2000). Total soluble tannins percentage in the flesh was determined according to Balbaa (1981). Acidity was determined as g. citric acid /100 g juice.

Statistical analysis

The experiment was arranged in Randomized Complete Blook Design according to Snedecor & Cochran (1980). Mean separation was came out using the method of New Least Significant differences (New L.S.D.) described by Waller & Duncan (1969).

Results and discussion

Male morphological properties

Data in Tables (1 and 2) indicated that Ghanamy and Sabad gave the highest significant values of spath no., spath width and stand no., without significant difference in-between in both seasons. While Fard and Dairy were gave the lowest values without significant difference in-between in both seasons (24.5 and 24.5, respectively). Regarding to Spath length in both seasons Ghanamy gave the lowest significant length. Referring to spath

width Dairy gave the lowest significant values in both seasons. Concerning the stand length no, significant differences could be noticed between males in both seasons.

Data in Figure (1) referred to germinated pollen and pollen tube growth in media for five males date palm (Ghanamy, fard, Dairy, Sabad and Sewi local male) under study. The results showed that pollen tube growth of Fard was the Fastest one followed by, Ghanamy, dairy and sabad respectively. This result was harmony with Kavand *et al.*, 2014 who study the effect of boron and calcium concentrations on Fard and Bream pollen grains and they showed that each cultivar has specific pollen germination properties that is related to its genetic are makeup, and medium components.

Table (1) Morphological properties of different male types used for Barhee date al cv. Pollination during 2017 and 2018 seasons.

Male	Spath no.	Spath length	Spath width	Stand no.	Stand length
	First season				
Ghanamy	29.00	61.00	20.67	285.00	15.38
Fard	24.67	84.00	16.33	176.30	14.67
Dairy	24.67	80.00	14.67	177.70	14.67
Sabad	28.33	88.00	20.33	351.00	15.33
Sewi	25.00	65.00	17.00	274.30	15.00
New L.S.D	1.45	2.66	1.08	63.00	0.85
Second season					
Ghanamy	28.67	60.33	21.00	286.30	14.33
Fard	24.33	84.00	16.33	210.70	14.33
Dairy	24.33	80.00	14.67	173.30	14.00
Sabad	28.00	88.67	20.67	318.00	15.00
Sewi	26.00	66.67	17.67	280.00	14.33
New L.S.D	1.22	3.47	0.99	50.05	1.62

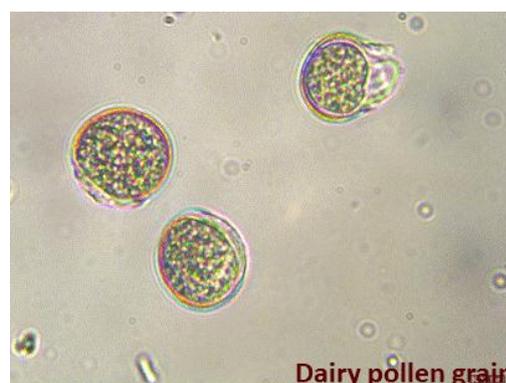




Figure (1) Germinated pollen and pollen tube growth

Fruit set percentage and Fruit retention

Data in Table (3) revealed that there was a wide variation in fruit set % and fruit retention between the different males of date palms under Egypt conditions during 2017 and 2018 seasons Dairy male gave the highest value of fruit set and fruit retention followed by Ghanamy in both seasons. Sabad gave the lowest values of fruit set % and fruit retention in both seasons. These results goes in line with those found by Salem & Hamdy (1993) who found that fruit set were 86.6 % Barhee and 82.8% Sewi respectively. Also, agreement with those was reported by Ibrahim and Shahid (1994). They found differences in the effectiveness among six males in fruit setting. Similarly, El-Amer (1993) reported variation in fruit setting due to pollen source. Iqbal *et al.* (2004) also reported the similar results.

Bunch weight (Kg)

Regarding bunch weight, data cleared that Fard gave the heaviest significant bunch weight (kg) in both seasons. The lightest bunch weight was noticed with control pollen during two studied seasons. These results were agree with Al-Hamoudi *et al.*, (2006) who reported that the Ghanamy and Fard male types were superior in their morphological characters. Moreover, they improved bunch weight and fruit quality.

Table (2) Effect of some male date palm as pollinators on Fruit set, Fruit retention and Bunch Weight (Kg.) of Barhee cultivar grown under Egypt condition during 2017 and 2018 seasons.

Cultivar	Fruit set			Fruit retention			Bunch Weight(kg)		
	1 st	2 nd	M	1 st	2 nd	M	1 st	2 nd	M
Ghanamy	69.00	71.00	70.00	61.33	61.00	61.17	17.67	18.33	18.00
Fard	51.67	53.00	52.34	44.00	44.00	44.00	24.67	25.00	24.84
Dairy	76.00	73.67	74.84	63.67	62.33	63.00	19.33	20.33	19.83
Sabad	26.00	26.33	26.17	22.00	22.67	22.33	14.67	15.00	14.83
Sewi	50.33	50.67	50.50	44.00	45.00	44.50	8.33	8.67	8.50
New L.S.D	3.21	1.78		3.399	2.69		2.38	1.95	

Fruit quality:

Fruit physical characteristics:

Fruit weight: Data in Table (3) indicated significant differences in fruit weight of Barhee cv. of date palm under study. Fard and Dairy (16.9 & 15.9) (16.8 & 15.79) gave the heaviest fruit weight in both seasons respectively, followed by Ghanamy and control respectively. While Sabad gave the highest fruit weight (15.67 & 14.6 g, in both seasons respectively).

Fruit length: As for fruit length data in Table (3) indicated significant differences. Fard pollen recorded the tallest fruit (3.63 & 3.47 cm). While Sabad and Sewi pollen recorded the shortest fruit value (3.14 & 3.1 cm) and (3.14 & 3.03 cm, in both seasons respectively).

Fruit diameter: Concerning of fruit diameter data showed that Dairy gave the highest fruit diameter in both seasons (2.73 and 2.73 cm, respectively), followed by Fard (2.73 and 2.70 cm, respectively), while Sabad gave the lowest fruit diameter in both seasons (2.17 and 2.07cm, in both seasons, respectively).

Seed weight: Regarding seed weight, the results indicated significant differences in both seasons as shows in Table (3). In the first season, Fard and Dairy gave the heaviest seed weights (1.32 and 1.32 g), while Sabad gave the lightest seed weight (0.90 and 0.66 g) in both seasons, respectively.

Flesh weight: Concerning flesh weight, the results indicated that Fard gave the highest Flesh weight (g) in both seasons. Sabad gave the lowest flesh weight (13.48 g) in the second season.

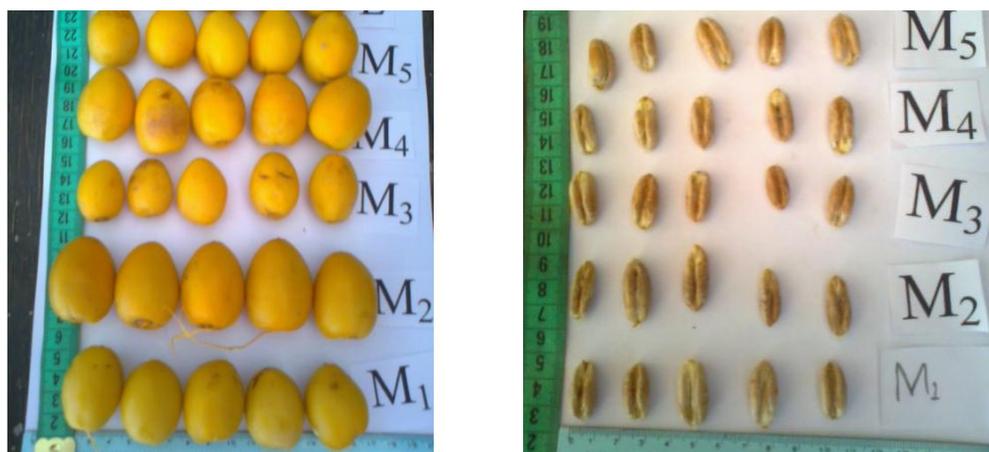
Flesh weight%: Regarding flesh weight%, the results indicated significant differences in both seasons as shows in Table (3). Sewi gave the highest flesh weight% in both seasons (94.42 & 95.62) respectively.

Fruit thickness (cm): The obtained results indicated that the highest significant flesh thickness was clearly by Sabad pollen compared with other pollen in both seasons (0.943 & 0.933 cm). While Ghanamy pollen gave the lowest values (0.616 & 0.533cm) in both seasons respectively.

These findings support the results of Iqbal *et al.*, (2008) whom reported that pulp weight was affected due to different pollen sources. Khalifa *et al.*, (1980) whom reported that pollen shave direct effect on fruit weight. Abdel (2000) reported that specific pollens had significantly effect on the fruit length. Rahemi (1998) reported that pollens from different males were affected significantly the breadth of fruits. Al- Ghamdi *et al.*, (1988) reported that seed weight was significantly affected due to different pollen sources.

Table (3) Effect of some male date palm on fruit physical characteristics of Barhee cultivar grown under Egypt condition during 2017 and 2018 seasons.

Cultivar	Fruit Weight(g)	Seed Weight(g)	Flesh weight	Flesh %	Fruit length(cm)	Fruit Diameter(cm)	Fruit Thickness(cm)
Frist season							
Ghanamy	16.43	1.167	15.27	92.9	3.18	2.43	0.6167
Fard	16.90	1.323	15.58	92.17	3.63	2.73	0.8333
Dairy	16.83	1.317	15.52	92.18	3.53	2.73	0.8100
Sabad	15.67	1.227	14.44	92.17	3.14	2.17	0.9433
Sewi	16.13 c	0.9000	15.23	94.42	3.14	2.53	0.7567
New L.S.D	0.403	0.0959	0.388	0.585	0.184	0.055	0.0544
Second season							
Ghanamy	15.43	1.13	14.30	92.67	3.11	2.40	0.5333
Fard	15.9	1.27	14.63	91.99	3.47	2.70	0.8667
Dairy	15.7	1.27	14.43	91.89	3.50	2.73	0.8167
Sabad	14.67	1.19	13.48	91.91	3.10	2.07	0.9333
Sewi	15.23	0.66	14.58	95.62	3.03	2.33	0.7700
New L.S.D	0.418	0.407	0.646	2.62	0.157	0.157	0.0783



M₁ = Dairy , M₂ = Fard, M₃ = Sabad , M₄ = Ghanamy, M₅ = control

Fig (2): Effect of different date palm male on fruit quality of Barhee cv.

Fruit chemical characteristics:

Table (4) show percentage of acidity, T.S.S, total sugars, reducing sugars and non-reducing sugars in fruits of Barhee cv.

Regarding Acidity: The results indicated that no significant differences could be noticed in both seasons as shows in Tables (4) Control gave the lowest total acidity percentage in both seasons (0.0848 and 0.0803, respectively), while Fard gave the highest total acidity percentage in both seasons (0.1063 and 0.1007 % respectively).

Total soluble solids (T.S.S.): Data presented in Table (4) cleared that Fard recorded the superior value of total soluble solids percentage (30.43 and 29.17) in the first and second seasons, respectively, while, Sabad and Control gave the lowest total soluble solids percentage (23.33 and 23.33), without significant differences in between.

Total sugar percentage: Data in Table (4) indicated that the total sugars percentage was significantly differ among date palm strains under study, Fard gave the highest total sugars percentages (47.12 and 45.98 %) in both seasons, respectively). While Sabad and Control gave the lowest total sugars percentages

Reducing sugars percentage: In both seasons, Fard and Dairy gave the highest reducing sugars percentage, while control gave the lowest reducing sugars percentage (15.27) in the second season

Non -reducing sugars percentage: Data clear that, Fard gave the highest percentage of non-reducing sugars percentages in the fruits of Barhee under study, 27.20 and 26.90 %, respectively in both seasons. While, Sabad and Control gave the lowest percentage (25.52 and 25.52 %)

Sugar content of the fruit that affected by pollen grain might be due to the activities of enzymes system initiated by metaxenia effect and later on passed into extra cellular sites, get dissolved readily into water and invert the sugars (Hasegaw and Swolensky, 1971). Regarding the effect of pollen grain on reducing sugar content, it took a similar trend of total sugar contents. These findings are in agreement with those reported by Hossein *et al.* (1979) and Shaheen *et al.* (1989) who stated that specific pollens may possibly affected cell member in early fruit development response of female tissue to hormones or auxins introduced in the ovary by pollen source.

Table (4) Effect of some date palm males on fruit chemical characteristics of Barhee cultivar grown under Egypt condition during 2017 and 2018 seasons.

Male	Acidity	T.S.S	Total sugar	Reducing sugar	Non reducing sugar
Ghanamy	0.0876	25.10	42.36	16.43	25.93
Fard	0.1063	30.43	47.12	19.92	27.20
Dairy	0.1012	29.00	45.83	18.98	26.85
Sabad	0.0838	24.00	41.38	15.71	25.67
Sewi	0.0848	24.30	41.68	15.91	25.77
New L.S.D	0.0554	2.09	1.86	1.37	0.49
Second season					
Ghanamy	0.0911	24.33	41.68	15.93	25.75
Fard	0.1007	29.17	45.98	19.09	26.90
Dairy	0.0919	27.77	44.74	18.39	26.56
Sabad	0.0815	23.33	40.79	16.14	25.52
Sewi	0.0803	23.33	40.79	15.27	25.52
New L.S.D	0.0554	0.86	0.769	1.088	0.207

Conclusion

The results clearly refer to Fard pollen produced the highest fruit weight (g) length, diameter, flesh weight, flesh % and bunch weight (kg). Data also revealed that dates that were picked from bunches pollinated with Dairy and Fard pollen had the highest total soluble solids (T.S.S.) values, total sugar, reducing and non-reducing sugars.

References

- Abdel-Hamid, N., 2000.** Effect of time, rate and patterns of thinning, leaf bunch ratio and male type on "Zaghloul" date yield and quality. Arab. Uni. J. Agric. Sci., 8 (1): 305-317.
- Al-Ghamdi, A.S., G.M. Al-Hassan and M. Jahjah, 1988.** Evaluation of eight seedling date palm (*Phoenix dactylifera* L.) males and their effects on fruit character of three female cultivars. Arab Gulf J. Sci. Res., 6 (2):175-187.
- A.O.A.C., 2000.** Official Methods of Analysis 17th Ed. USD.
- Al-Hamoudi, A.H., A.M. El-Hammady, L.M. Desouky and A. Abdel Hamid, 2006.** Evaluation of some male types as pollinators for Barhi date palm cv. Grown in Egypt. Arab Univ., J. Agric. Sci., Ain Shams Univ., Cairo, 14 (1): 365-377.
- Al-Muhtaseb, J.A. and H.D. Ghnain, 2006.** Effect of pollen source on yield, quality and maturity of "Barhi" date palm. Jordan J. Agric. Sci., 2 (2): 9-14.
- Aly, M.A., 2001.** Effect of pollen sources on fruit set and yield components of three date palm cultivars (*Phoenix Dactylifera* L.) Adv. Agric. Res., 6 (1): 41-55.
- Balbaa, S.I., 1981.** Chemistry of Crude Drugs (*Laboratory manual*) Cairo Univ. Chapter 6 pp 127-137.
- El-Kosary, S. and S.S. Soliman, 2003.** Samani and Zaghloul date palm cultivars (*Phoenix Dactylifera* L.) productivity as influenced by different pollen source and two hand pollination, Assuit J. Agri. Sci., 34 (2): 65-97.
- El-Mkhtoun, F.M.B., 1981.** Effect of different pollen types on fruiting and fruit quality in some date varieties. M.S.c. thesis, Dept. Hort. Fac. Agric. Al-Azhar Univ. Egypt.

- Hasegaw, S. and D.C.S Molensky, 1971.** Cellulose in dates add its role in fruit softening. J. Food Sci., 36: 966-967.
- Helail, B.M. and A.K. Hassan, 2001.** Effect of pollen grain sources on palm fruiting and date quality of Halawy and Khadrawy date palms. Minufiya J. Agric. Res., 26 (1): 125-141.
- Hussein, F., S. Moustafa and M.A. Mahmoud, 1979.** The direct effect of pollen (metaxinia) on fruit characteristics of date grown in Saudi Arabia. Proceedinds of 3rd Conference on the biological Aspects of Saudi Arabia, January 24-27 1979, Al-Ahssa, Saudi Arabia, pp: 69-78.
- Hussein, I.A., E.I. Bakr and S.M. Osman, 1999.** Effect of pollen source on physical and chemical fruit characteristics of date (*Phoenix Dactylifera* L.). Zagazig J, Agric. Res., 26 (4): 1137-1146.
- Iqbal, M., A. Ghaffoor, A. Jalaluddin and M. Munir, 2008.** Effect of different date males pollinizer on fruitl charactersicts and yield in dex of date palm (*Phoenix dactylifera* L.) cv. Zahidi and Dhakki. Pakistan J. Agric. Res., 21 (4): 79-85.
- Khalifa, A., S. Azzouz, Z.M. Hamdy , H. El-Masry and M. Yousef, 1980.** Effect of source of pollen on the physical and chemical quality of “Amhat” date variety. Agric.Res.Rev., 58 (3):15-23.
- Kavand, A., A. Ebadi, Y.D. Shuraki and V. Abosi, 2014.** Effect of calcium nitrate and boric acid on pollen germination of some date palm male cultivars. European Journal of Experimental Biology, 4 (3):10-14
- Khamis, M.M., M.M. Shrf, A.A. El-Bana and H.S. Ghazawy, 2010.** Evaluation of some pollen grain sources on fruiting and fruit quality of Siwi and Zaghoul date palm Cvs. Egypt, J. Appl. Sci., 25 (1): 25-39.
- Khushk, A.M., A. Memon and K.M. Aujla, 2009.** Marketing channels and margins of dates in Sindh, Pakistan. J. Agric. Res., 47 (3): 293-308.
- Mason, S.C., 1927.** Date culture in Egypt and Sudan. USDA Bul. No. 1457, 27 pp.
- Omaima, M. Hafez, A.M. Saleh, N.E. Ashour, E.A.M. Mostafa and M.M. Naguib, 2015.** Evaluation of Some Pollen Grain Sources on Yield and Fruit Quality of Samany Date Palm cv. (*Phoenix dactylifera* L.) Middle East Journal of Agriculture Research, 4 (1): 27-30
- Rahemi, M., 1998.** Effect of pollen source on fruit characters of Shahani date. Iranian J. Agric. Res., 17 (2):169-174.
- Salem, M.S. and Z.M. Hamdy, 1993.** Evaluation of some Iraqi date vultivars under condition of Upper Egypt. Egypt J. Applied. Sci., 8 (5): 250-269.
- Snedecor, G.W. and W.G. Cochran, 1980.** Statistical methods 7th Ed. The Iowa State Univ. Press. Amer., pp: 365-372.
- Waller, R.A. and D.B. Duncan, 1969.** A buyes rule for the symmetric multiple comparison problems. Amer. State. Assoc. J., 64:1484-1503.

تأثير بعض ذكور نخيل التمر علي الجودة والمحصول لصنف نخيل البرحي

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الملخص العربي

أجريت هذه الدراسة خلال عامي 2012، 2013م بهدف دراسة تأثير التلقيح بخمسة ذكور نخيل التمر علي المحصول والجودة لصنف البرحي المتزرع بمحافظة البحيرة تحت ظروف جمهورية مصر العربية. وقد تم إختيار أربعة أباء (ناتج زراعة الأنسجة) نامية بمزرعة خاصة بمنطقة الصف بمحافظة الجيزة بمصر وهي الغنامي – الفرض – الدايري – الساباد وتم إختيار الفحل الخامس من المزرعة كنترول (ملقح المزرعة).

وتم دراسة الصفات الخضرية لهذه الأباء مثل عدد النورات للأفحل وزن وطول وعرض الأغريض ومتوسط طول الشماريخ داخل الأغريض. ومعدل الإنبات كما تم إستخدام حبوب اللقاح من كل من الأباء المشار إليها في تلقيح النورات الزهرية لصنف البرحي (ناتج زراعة أنسجة) وذلك لدراسة تأثير لقاح الأباء المختلفة علي النسبة المئوية لعقد الثمار ووزن العنق وبعض الصفات الطبيعية والكيميائية للثمار الناتجة.

وقد أوضحت النتائج أن كل من الفحلين الغنامي والساباد كانا مميزين في معظم القياسات المورفولوجية وذلك بمقارنتهما بباقي الفحول تحت الدراسة كما أوضحت البيانات أن الفحل دايري كان أقل الأباء في القياسات المورفولوجية .

وقد أوضحت النتائج أن حبوب لقاح الغنامي والدايري سجلت أعلى قيم لعقد الثمار يليه لقاحي الفرض والكنترول بينما كانت أقل القيم لعقد الثمار للقاح الساباد. بينما أنتج لقاح الفرض أعلى القيم لوزن السوباطة ووزن وقطر وطول الثمرة وكذلك أعلى وزن لحم للثمرة وقد أوضحت الدراسة أيضاً أن لقاحي الدايري والفرض أعطى أعلى قيم للمواد الصلبة الذائبة والسكريات الكلية والمختزلة والغير مختزلة في ثمار البرحي.

الكلمات الدالة: فحول نخيل التمر، جودة الثمار، المحصول، حبوب اللقاح، صنف البرحي.