EVALUATION OF DATE PALM MALES USED IN POLLINATION IN THE CENTRAL REGION, SAUDI ARABIA*

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ABSTRACT

Male palms used in pollination of date palms in the Central Region of the Kingdom of Saudi Arabia, were evaluated. The objective was to select highly potent male palms to raise standard male varieties. This evaluation involved about 600 males located in 209 date palm orchards in the different sects of the Central region.

Evaluation involved time of flowering, spathe characteristics (weight, length and width), strand characteristics (number, length and number of flowers/strands), and weight of pollen grains/spathe. The time of flowering differed from one male to another, and they also differed in both spathe and strand characteristics. The amount of pollen grains produced/spathe varied from one male to another, *i.e.* from 0.02-82.29 g/spathe.

In view of the above results, selection of males was based on the amount of pollen grains produced per spathe together with some other characteristics including weight and size of the spathes, number of strands per spathe and number of flowers per strand.

Key words: Spathe characteristics, strand characteristics, pollen weight.

INTRODUCTION

In most date palm growing countries including Saudi Arabia, seedling males are used for pollination. These seedling males are highly variable, in the sense that they differ greatly in their growth, vigour, spathe characteristics and pollen quality (Nixon, 1959; El-Sabrout, 1979). Date palm growers use pollen that is readily available. As a result, yield and fruit quality of the palms, differ greatly from one year to another (Nixon, 1934, 1956; Ahmed and Ali, 1960; Al-Delaimy and Ali, 1969; Osman *et al.*, 1974). The growers now beginning to realize the need for selection of males.

An intensive research project, sponsored by King Abdul-Aziz City for Science and Technology, was initiated to evaluate different male palms that are used in pollination in the Central region of Saudi Arabia, then to propagate and multiply the promising males vegetatively with their offshoots.

MATERIALS AND METHODS

This investigation was commenced in 1984, at the College of Agriculture, King Saud University, to evaluate male palms. The Central region was divided into 4 main sections, namely:

1. Riyadh and its suburbs.
2. Al-Kharj and Wadi El-Dawaser.

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3. Sedaer and Shakra.
4. Qassim.

This evaluation involved 601 male palms from 209 date palm orchards in the above mentioned sections. Palms selected were of more or less the same age and vigour.

Palms having offshoots, to allow further propagatin were selected.

At blooming, 1-3 matured spathes were collected from each male palm for spathe characteristic studies. Grouping of the males with respects to time of flowering (early, medium and late) was determined.

The following morphological characteristics were studied:

1. Spathe weight.
2. Spathe length.
3. Spathe width.
4. Sheath weight.
5. Inflorescence weight.
6. Inflorescence length.
7. Length of strandless part of rachis.
8. Number of strands/inflorescence.
9. Length of strands.
10. Length of strand part occupied with flowers.
11. Number of flowers/strand.
12. Weight of pollen grains/spathe.

For pollen grains extraction, the strands of each spathe were cut off and spread in a thin layer on paper sheets for 3-4 days till they became dry. Then the pollen grains were separated from the flower parts by using fine sieves. The pollen grains were stored in desiccators for 24 hours. Then the weight of the pollen of each spathe was determined.

Simple linear correlations coefficients for weight of pollen grains and each of the characters studied were calculated. A multiple linear regression equation was developed to predict pollen yield from other variables.

RESULTS AND DISCUSSION

Based on time of flowering, the males were grouped as follows:

a) Early flowering, during February.
b) Mid flowering, during March.
c) Late flowering, during April and sometimes extended till the first week of may.

Early flowering males are important as these provide pollen to be used in pollinating early flowering cultivars.

Number of Spathes/Palm

This number ranged between 10 to 30 in the different males and in different orchards.

Morphological Characteristics of the Spathes

The results obtained from the evaluation of male palm in the Central region showed great variability in the morphological characteristics of the spathes of various males. These results are summarized as follows:

Spathe Weight

The weight of the spathes ranged from 105 to 3,683 g in the different males. The spathes could be divided into 3 groups according to their weights:

a) Light: (less than 500 g), 25% of the tested males.
b) Medium: (500-1,000 g), 34% of the males.
c) Heavy: (more than 1,000 g), 40% of the males.

Spathe Length

The length of the spathes ranged from 25 to 119 cm. They were divided into 3 groups:

a) Short: Less than 50 cm, 41%.
b) Medium: From 50-100 cm, 44%.
c) Long: More than 100 cm, 16%.

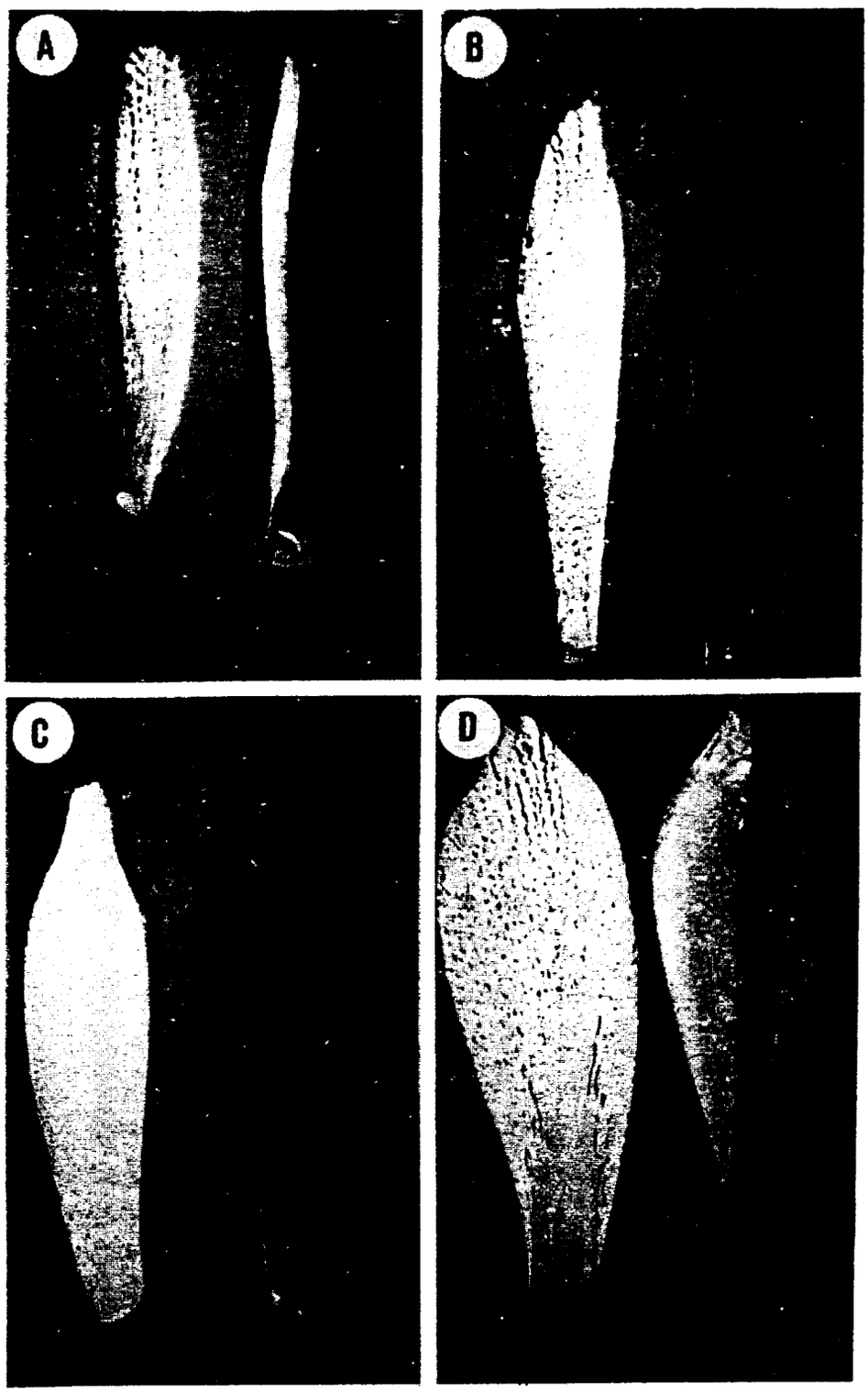

Figure 1. Different shapes and size of male spathes.

Spathe Width

The width of the spathe differed from 3.50 to 22.5 cm and it could be divided into 3 groups as follows:

a) Small: Less than 10 cm, 16%.
b) Medium: From 10-15 cm, 54%.
c) Big: More than 15 cm, 30%.

Other spathe characteristics (sheath weight, weight and length of inflorescence length of strandless part of rachis) followed the same trend as for the above mentioned characteristics and the results of which are presented in Table 1 and Fig. 1.

Characteristics of the Strands

Date pertaining to various characteristics of the strands are shown in Table 2.

Number of Strands/Inflorescence

The number of strands of each inflorescence varied from 23 to 420 strands. The inflorescence could be divided into 3 groups:

a) Few: Less than 100 strands, 22%.
b) Medium: From 100-150 strands, 34%.
c) Many: More than 150 strands, 44%.

Length of Strands

Length of strands ranged from 5.20 to 38.01 cm (Fig. 2) and the males were classified into 3 groups:

a) Short: Less than 15 cm, 48%.
b) Medium: From 15-20 cm, 35%.
c) Long: More than 20 cm, 17%.

Table 1. Morphological characteristics of male spathes collected from different orchards of the Central region, Saudi Arabia.

Character	Range	Percentage of the total		
Spathe weight (g)	105-3683	<500 24.76	500-1000 35.86	>1000 39.38
Spathe length (cm)	25 - 119	< 50 41.35	50 - 100 43.96	>100 14.69
Spathe width (cm)	3.5 - 22.5	< 10 16.12	10 - 15 53.64	>15 30.24
Sheath weight (g)	20 - 1257	<200 40.94	200 - 400 37:52	>100 21.54
Inflorescence weight (g)	81 - 2426	<500 42.99	500 - 1000 40.34	>1000 16.67
Inflorescence Length (cm)	19 - 112	< 30 7.15	30 - 60 68.30	>60 24.55
Length of strandless part of rachis (cm)	0 - 43	< 5 46.83	5 - 10 23.69	>10 29.48

Table 2. Strands characteristics of the male spathes under evaluation

Character	Range	Percentage of the total		
Number of strands/ inflorescence	23 - 420	<100	100-150	>150
		24.76	35.86	43.68
Length of strands (cm)	5.20 - 38.01	< 15	15 - 20	> 20
		47.72	34.72	17.56
Length of strand part occupied with flowers	2.99 - 27.34	< 10	10 - 15	> 15
		29.13	43.97	26.90
Number of flowers/ strand	13.60 - 92.80	< 25	25 - 50	> 50
		11.69	66.38	21.93

Table 3. Weight of pollen grains/spathe.

Character	Range	Perecentage of the total		
Weight of pollen grain	0.02 - 82.29	5	5 - 15	15
		30.30	46.06	23.64

Part of Strand Occupied with Flowers

Length of strand portion occupied with flowers was also classified into 3 groups:

a) Short: Less than 10 cm, 29%.
b) Medium: From 10-15 cm, 44%.
c) Long: More than 15 cm, 27%.

Number of Flowers/Strand

Number of flowers/strand ranged from 13.6 to 92.8 and the males were classified into 3 groups:

a) Low: Less than 25, 12%.
b) Medium: From 25-50, 66%.
c) High: More than 50, 22%.

Weight of Pollen Grain

Weight of pollen grains per spathe of different males ranged from 0.02 to 82.29 g (Table 3). Also, the males were divided into 3 groups according to the amount of pollen grains:

a) Poor: Less than 5 g, 30%.
b) Medium: From 5-15 g, 36%.
c) Rich: More than 15 g, 24%.

It is evident from the foregoing results that the seedling males differ greatly in the morphological characteristics of the spathes. These results are in line with Nixon (1959), who stated that no two seedling

Table 4. Corelation matrix of pollen grains weight and spathe characteristics of evaluated males

Character	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}
Y	1.0000											
X_1	.2849	1.0000										
X_2	.4230	.3220	1.0000									
X_3	.3227	.6063	.6089	1.0000								
X_4	.4019	.6776	.6749	.6877	1.0000							
X_5	.3234	.9528	.3841	.6252	.6766	1.0000						
X_6	−.0002*	.44532	.1132	.2306	.2597	.4593	1.0000					
X_7	.3462	.5336	.5367	.5567	.7695	.5294	.0271*	1.0000				
X_8	.3688	.5115	.3953	.4235	.5625	.5200	.0695	.3557	1.0000			
X_9	.0691	.1525	.1289	.0994	.2469	.1552	.6681	−.0191*	.1943	1.0000		
X_{10}	.3647	.3958	.5170	.4805	.6057	.4290	.0986	.4357	.6498	.1788	1.0000	
X_{11}	.4130	.7085	.7027	.8429	.9647	.7164	.2682	.7547	.5664	.2161	.6240	1.0000

*N.S.

Y = Weight of pollen grains (g)
X_1 = Spathe length (cm)
X_2 = Spathe width (cm)
X_3 = Sheath weight (g)
X_4 = Inflorescence weight (g)
X_5 = Inflorescence length (cm)
X_6 = Length of strandless part of rachis (cm)
X_7 = Number of strands
X_8 = Length of strand (cm)
X_9 = Length of strand part occupied with flowers (cm)
X_{10} = Number of flowers/strand
X_{11} = Spathe weight (g)

palms are alike. Chandler (1958) reported that fruit trees raised from seeds are greatly heterozygous. In Algeria, Monciero (1950) showed that different males yielded different amounts of pollen grains. Wertheimer (1957) came to the same conclusion as with Monciero. In Egypt, different growth characteristics of the spathes in seedling males were noted by El-Sabrout (1979).

The results indicated that significant correlations existed between weight of pollen grains and most of other characteristics studied. Though the correlation coefficients were significant, their predicted values were low (Tables 4 and 5).

On the basis of the above results, 102 seedling males are selected to be propagated by their offshoots which will always reproduce the parent type. Then, it becomes essentially a new variety or clone.

Table 5. Regression equations of pollen grains weight and spathe characteristics

Equation	SE_E[a]	R[b]
$Y = -6.39 - 0.057X_1 + 0.652X_2 - 0.016X_3 - 0.0140X_4 - 0.159X_5 - 0.128X_6 + 0.008X_7 + 0.150X_8 + 0.034X_9 + 0.024X_{10} + 0.014X_{11}$	±6.92	0.52**
$Y = 2.81 + 0.123X_1$	±7.67	0.29**
$Y = 2.89 + 0.506X_2$	±7.25	0.42**
$Y = 6.57 + 0.013X_3$	±7.60	0.31**
$Y = 5.18 + 0.008X_4$	±7.32	0.40**
$Y = 2.31 + 0.160X_5$	±7.57	0.320**
$Y = 10.30 - 0.0001X_6$	±8.00	0.0002**
$Y = 4.11 + 0.042X_7$	±7.50	0.35**
$Y = 1.94 + 0.521X_8$	±7.43	0.37**
$Y = 10.01 + 0.021X_9$	±7.98	0.07
$Y = 0.69 + 0.235X_{10}$	±7.45	0.37**
$Y = 4.80 + 0.006X_{11}$	±7.28	0.41**

a Standard Error Estimate (SE_E)
b Correlation coefficient (R)

Y = Weight of pollen grains (g)
X_1 = Spathe length (cm)
X_2 = Spathe width (cm)
X_3 = Sheath weight (cm)
X_4 = Inflorescence weight (g)
X_5 = Inflorescence length (cm)
X_6 = Length of strandless part of rachis (cm)
X_7 = Number of strands
X_8 = Length of strand (cm)
X_9 = Length of strand part occupied with flowers (cm)
X_{10} = Number of flowers/strand
X_{11} = Spathe weight (g)

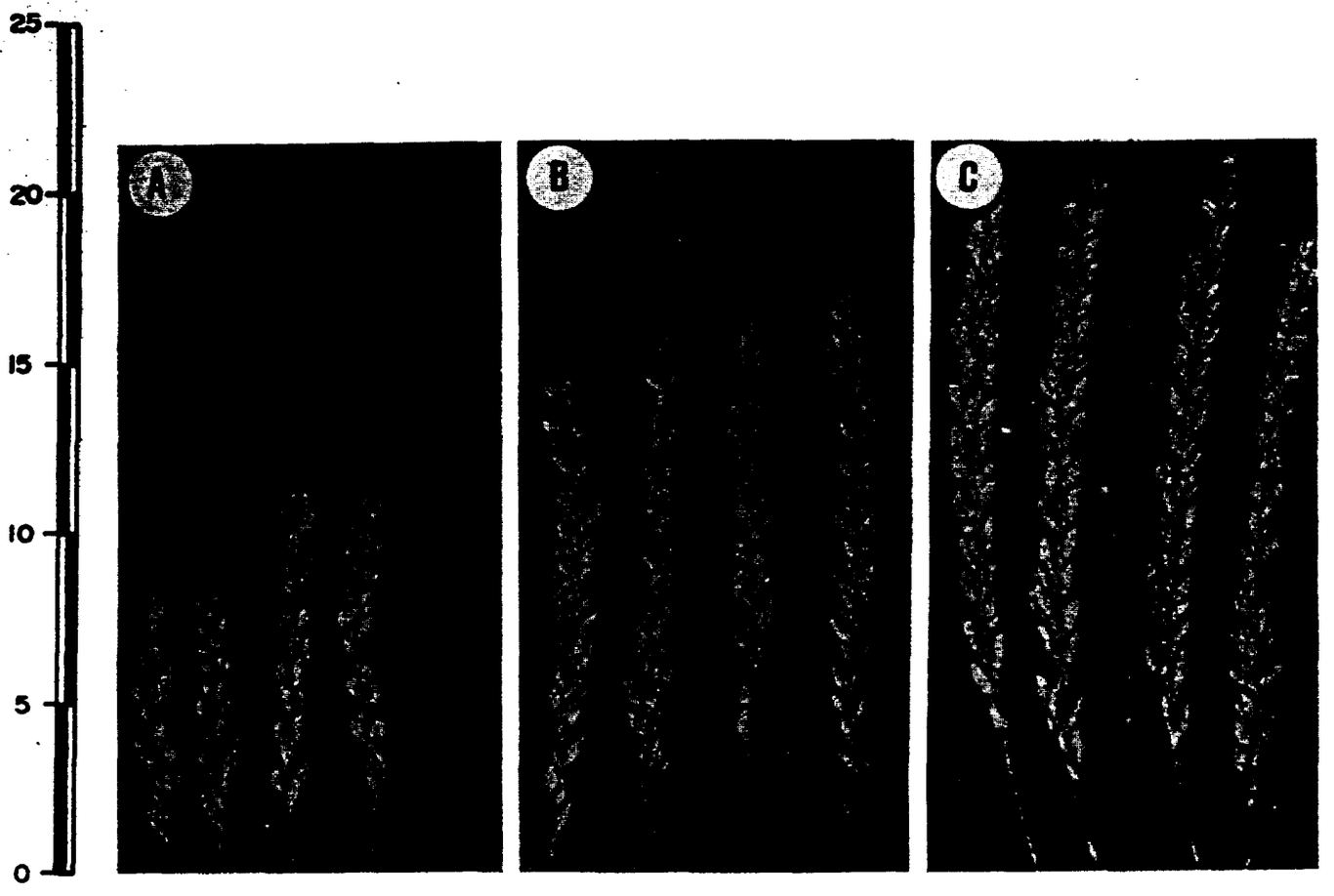

Figure 2. Showing different lengths of strands of males spathes. A. short B. medium C. long.

The basis of selection of male palms was the amount of pollen grains produced as suggested by Nixon (1959). He stated that in selecting male palms, the flowers should contain abundant pollen. In addition, other morphological characteristics of the spathes were also considered in selection, such as weight and size of the spathes, number of strands per spathe and number of flowers per strand.

CONCLUSION

Males selected in this evaluation are characterized with the following characteristics:

Spathe Characteristics

a) Weight: More than 1,000 g.
b) Length: More than 50 cm.
c) Width: More than 10 cm.
d) Number of strands: More than 100 strands.

Strands Characteristics

a) Length: More than 15 cm.
b) Number of flowers/strand: More than 40 flowers/strand.

Pollen Grains

Weight: More than 15 g per spathe.

LITERATURE CITED

Ahmed, M. and N. Ali 1960. Effect of different pollens on the physical and chemical characters and ripening of date fruits. Punjab fruit J. 28 (80): 10-11.

Al-Delaimy, K.S. and S.H. Ali 1969. The effect of different date pollen on maturation and quality of "Zahdi" date fruit. J. Amer. Soc. Hort. Sci. 94: 638-639.

Chandler, W.H. 1958. Evergreen Orchards. Lea and Febigers, Philadelphia, U.S.A.

El-Sabrout, M.B.I.K. 1979. Some physiological studies on the effect of pollen type on fruit-setting and fruit quality in some date palm varieites. M.Sc. Thesis. Faculty of Agriculture, University of Alexandria, Alexandira, Egypt.

Monciero, A. 1950. La Fecondation mechanique du plamier-dattier. Bul. D'Information 4 (38-1):81-86. Office Tunisien de standardation, Tunis (Congress International de la Datte), Tunis, 4-12 November.

Nixon, R.W. 1934. Recent pollination experiments. Date Grower's Inst. Rept. 11:9-11.

Nixon, R.W. 1956. Metaxenia in dates. Proc. Amer. Soc. Hort. Sci. 32: 221-226.

Nixon, R.W. 1959. Growing dates in the United States. Agric. Inform. Bull. No. 207. Agric. Res. Ser., USDA.

Osman, A.M.A., W. Reuther, and L.C. Erickson 1974. Xenia and metaxenia studies in date palm (*Phoenix dactylifera*, L.). Date Grower's Inst. Rept. 51: 6-16.

Wertheimer, M. 1957. La pollination du palmier-dattier (*Phoenix dactylifera*, L.). Fruits 12: 305-313, Paris.

تقييم ذكـور نخيـل البلح المستخدمة في التلقيح في المنطقة الوسطى بالمملكة العربية السعودية

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الخلاصـــة

اشتمل هذا البحث على تقييم ذكور نخيل البلح التي تستخدم في التلقيح في المنطقة الوسطى ، وكان الهدف الرئيس من هذا التقييم هو انتخاب الذكور الجيدة العالية الكفاءة لإنتاج أصناف مذكرة ثابتة الصفات .

واشتمل هذا التقييم على أكثر من ستمائة ذكر منزرعة في عدد من بساتين النخيل البالغ عددها ٢٠٩ بساتين في المنطقة الوسطى بالمملكة .

واشتمـل هذا التقييم على ميعـاد الإزهار، صفات الأغاريض (الوزن ، الطول ، العرض)، صفات الشـماريخ الـزهرية (العدد ، الطول ، عدد الأزهار بكل شمراخ ، وزن حبوب اللقاح بكل أغريض) . وتوضح النتائج أن ميعاد الإزهار يختلف بين الذكور المختلفة . كما وجد أن الأغاريض وكذلك الشماريخ الزهرية تختلف في صفاتها من ذكر إلى آخر . كما وجد أن كمية حبوب اللقاح التي تنتجها الأغاريض تختلف من ذكر إلى آخر وكانت هذه الكمية تتراوح من ٠٫٠٢ ــ ٨٢٫٢٩ جم / إغريض .

وعـلى ضوء النتـائـج السـابقة كان الأساس في انتخاب الذكور هو كمية حبوب اللقاح التي ينتجها الإغـريض بالإضافة إلى بعض الصفات الأخرى المهمة مثل وزن الاغريض وحجمه، وعدد الشماريخ الزهرية في الاغريض وكذلك عدد الأزهار في الشمراخ الزهري

الكلمات الدليلية : صفات الأغاريض، صفات الشماريخ الزهرية ، كمية حبوب اللقاح .