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Influence of Seed Size on Seed Yield and Its Components of Maize (*Zea mays*)

تأثير حجم البذرة في حاصل الحبوب ومكوناته لمحصول الذرة الصفراء

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Abstract

A field study was conducted at an agriculture field in Babylon governorate /Musaiyib district to sort out the seed size effect on yield and yield components of maize. Two seed sizes i.e. small and large have diameter less than 7 mm. and more than 7 mm. respectively which they have accumulated from tip and base of ear respectively. The hybrid A6 X A1 and inbred A6 was used. The experiment was laid out in randomized complete block design with factorial arrangement with three replications. The hybrid significantly surpassed it's inbred in ear weight, seed weight, seed yield and percentage of small seeds, while inbred exceeded its hybrid in row number. Non significant between hybrid and inbred was observed in seed number and ear length. The differences in seed size resulted in non significant effect on ear length, ear weight, seed number/ear and row number/ear, while seed weight seed yield and percentage of small seeds/ ear was responded for seed sizes. The percentage of large seeds superiority to small seed size in seed weight and seed yield was 5.4% and 10.5% respectively, while percentage of small seed size was 17.7% and 21.4% for large and small seed respectively. The decreasing of small seeds percentage is due to low aneuploidy of endosperm cells for large seed. It is concluded that large seed is the best for giving high seed yield a result of raise percentage of germination, seed weight, decreasing the percentage of small seeds and uniformity. At the end, it may be inferred from this research that further research may be conducted.

المستخلص

طبقت دراسة حقلية في حقل زراعي في محافظة بابل/قضاء المسيب لمعرفة تأثير حجم البذرة في حاصل حبوب الذرة الصفراء ومكوناته.أستخدمت بذور صغيرة(اقل من ٧ ملم) وكبيرة (أكثر من ٧ ملم) والتي تم الحصول عليها من قمة وقاعدة العرنوص بالتتابع لكل من الهجين A6 X A1 وسلالته A1. أستخدم تصميم القطاعات الكاملة المعشاة بتجربة عاملية بثلاثة مكررات.بينت النتائج تفوق الهجين على سلالته في وزن العرنوص ووزن الحبة وحاصل الحبوب ونسبة البذور الصغيرة، بينما تفوقت السلالة على هجينها في عدد صفوف العرنوص.لم تلاحظ اي فروقات معنوية بين الهجين وسلالته في عدد الحبوب بالعرنوص وطول العرنوص. لم يؤثر حجم البذرة معنوياً في طول العرنوص و وزن العرنوص و عدد الحبوب بالعرنوص و عدد صفوف العرنوص ، بينما تاثرت صفات وزن الحبة وحاصل الحبوب ونسبة البذور الصغيرة باختلافات حجم الحبة.تفوق حجم الحبة الكبير على حجم الحبة الصغير في وزن الحبة وحاصل الحبوب بنسبة ٥.٤% و١٠.٥% بالتتابع، بينما كانت نسبة الحبوب الصغيرة ١٧.٧% و٢١.٤% للبذور الكبيرة والصغيرة الحجم بالتتابع.ان انخفاض نسبة الحبوب الصغيرة عند زراعة بذور كبيرة يرجع الى حالة aneuploidy لخلايا سويداء البذور الكبيرة.يمكن الأستنتاج من هذه الدراسة ان البذور الكبيرة الحجم ضرورية للحصور على حاصل حبوب عال نتيجة لأرتفاع نسبة الأنبات وزيادة وزن الحبة وتقليل نسبة الحبوب الصغيرة وزيادة التجانس.

Introduction

Maize is an important crop for human and animals. Although maize have a great yield potential, yet its average yield in Iraq very low as compared to other important maize growing countries of the world. There are many factors responsible for this low yield. Seed quality plays an important role in germination, seedling vigor, ultimately seed yield and its components. In study about performance of the farmers in Ethiopia, it has been found that 80% of the farmers select high quality seeds to improve maize yield (1).Small seeds ranging from about one-tenth to three-fourths of the normal seeds (2). (3) reported that genotypes are various responses to variation in seed size and recommended to use the largest possible seeds to obtain highest seed yield in maize. Many studies have been conducted to investigate the effect of seed sizes on yield and its components (3, 4; 5; 6, and 7). The present study was carried out with aim to determine the effect of seed sizes of the yield and its components of two genotypes of maize.

Materials and Methods

The experiment was conducted at an agriculture field in Babylon governorate /Musaiyib district (between cross lines 36.2- 36.3 northward, 29 m above sea level) for spring season 2008.Two seed sizes i.e .small (the diameter is less than 7mm) and large (the diameter is more than 7mm) which represented tip and base sites of cob. Two genotypes of maize (*Zea mays L*.) was used (hybrid A6XA1 and its inbred A1). The experiment was laid out in randomized complete blok design with factorial arrangement with three replications. The crop was sown in mid of March in plot having five rows 75 cm apart, with 25 cm plant to plant distance. Dap fertilizer (N 18%, P 18%) was applied at the rate of 300 Kg. /ha.and nitrogen fertilizer was applied in form of urea at the rate of 300 Kg. /ha. The whole quantity of dap and half of urea were applied at the time of sowing, the other half of urea was applied at flowering stage. All other agronomic practices were kept normal and uniform for all treatments. The data were recorded on ear length, ear weight, number of rows /ear, number of seeds/ear, weight of 300 seeds, seed yield (only for upper ear) and the percentage of small size seeds. The data of small size seeds percentage were transformed by arcsine square root method. All data were analyzed by fisher's analysis of variance technique using least significance difference test (LSD) at 0.05 probability level (8).

Results and Discussion

The statistical analysis of data showed that genotypes had non-significant effect on the ear length (Tab.1). In case of seed sizes, data also showed non-significant effect on the ear length. However, maximum ear length of 17.7 cm was achieved from large seed. Genotypes significantly effected the ear weight (Tab. 2), where, the hybrid exceed it's inbred by 29% for ear weight, whereas, seed sizes and interaction gave a non- significant effect on this character in spite of maximum ear weight achieved from large seed. The dominance of hybrid is due to it's effectiveness SCC (System Constant Capacity) which is resulting in accumulation a greater dray matter on ear as compared with it's inbred (9).The row number/ear acted the same way of ear weight. The genotypes significantly effected number of row/ear (Tab.3). Maximum row number/ear was investigated in hybrid which is exceeding it's inbred by 5%. Seed size and interaction had no effect on number of row/ear. Genotypes and seed sizes had no significantly effect on seed number/ear (Tab.4), in spite of maximum seed number/ear were recorded with hybrid and large seed. Their interaction was also found to be non- significant. These results are in line with (6), but Khan and et al (5) and (10) have found significant effect of large seed on seed number/ear.

A perusal of data (Tab.5) indicated that seed weight of genotypes and seed sizes were significant trend, but their interaction was non- significant. The hybrid exceed it's inbred by 29%, whereas, large seed showed greater seed weight which dominated the small seed by 5.4%. These results are agreement with (10) and (11). It was observed that ears which have resulted from planting of large seeds size had heavy seeds at tip as compared with ears which have resulted from planting of small seeds size. This may declare that effect of large seed is reflecting on increase seeds weight of ear tip, and this effect was certified by strong negative correlation between seed weight and percentage of small seeds (data not show).It is clear from data (Tab.6) that seed yield was highly significantly effected between genotypes and significantly effected between seed sizes, but their interaction was found to be non-significant. The hybrid exceeded it's inbred by 33%, whereas the large seeds dominated on small seeds by 10.5%. This is in similarity with (5), (10), (11), (12) and (13). The data pertaining to percentage of small seeds is tabulated in table 7. Genotypes highly significantly effected of percentage of small seeds, where, the hybrid posed 8.7% of small seeds as compared with it's inbred which it posed 30%.In the case of seed sizes, data depicted that they had effect on percentage of small seeds, were, minimum percentage of small seeds applied with large seeds which they own 17.5% as compared with 21.4%(figure 1) that obtained from small seeds. Their interaction was found to be non-significant. The size of small seeds is ranging from about one-tenth to three-fourths of the large seeds. The small seeds reduction results from an aneuploid chromosome in the endosperm cells (11 and 12). (2) germinated 26 large seeds and 22 small seeds and he found that 3% of large seeds own small seeds with 19 chromosomes in their endosperm cells(aneuploid) and 97% was large seeds with 20 chromosomes in their endosperm cells. In the case of small seeds, 18% were trisomic and 22% were monosomic. The frequency for small seeds is 41% which is nearly ten times higher than that of the large seeds.

The current study demonstrated that differences in seed size had an effect in seed yield. This is probably due to its effect on accelerating the germination and seedling development, consequently, competitive plant is derived. In addition, large seeds size would increase absorbing nutrients, especially nitrogen which is major element in amino acid formation (16). The major yield component that is increased by large seed size is seed weight. The percentage of small seeds is decreased by using large seed (Tab.5 and 7). The two prior characters correlated with seed yield(r=.91,-.83 respectively). (12) reported that increasing in seed yield when large seed is planted may due to decrease the missing plants.

As a result of decreasing of small seeds percentage by large seeds planting, estimation of seed weight that are sampled randomly would not effect by low percentage of small seeds as compared with high percentage of small seeds. Also, decreasing of small seeds percentage will raise the percentage of germination and seedling development, consequently, increasing seed weight and seed yield. We can recommend that both researchers and farmers should use large seeds to ensure the uniformity of plant growth and high yield.

Table 1.Effect of seed size and genotype on ear length (cm)

	S1(Lessthan7mm)	S2(Morethan7mm)	Mean
Hybrid	**16.70**	**17.13**	**16.92**
Inbred	**16.70**	**18.37**	**17.53**
L.S.D.	**n.s.**		**n.s.**
Mean	**16.70**	**17.75**	
L.S.D.p 5%	**n.s.**		

Table 2.Effect of seed size and genotype on ear weight (gm)

	S1(Lessthan7mm)	S2(Morethan7mm)	Mean
Hybrid	**108.5**	**111.9**	**110.2**
Inbred	**75.6**	**95.2**	**85.4**
L.S.D.	**n.s.**		**18.7**
Mean	**92.0**	**103.5**	
L.S.D.p 5%	**n.s.**		

Table 3.Effect of seed size and genotype on row n. / ear

	Lessthan7mm	Morethan7mm	Mean
Hybrid	13.73	14.36	14.18
Inbred	15.03	14.97	15.0
L.S.D.	n.s.		.80
Mean	14.38	14.80	
L.S.D.p 5%	n.s.		

Table 4.Effect of seed size and genotype on seed n. / ear

	S1(Lessthan7mm)	S2(Morethan7mm)	Mean
Hybrid	**362.3**	**401.3**	**389.0**
Inbred	**415.7**	**410.3**	**405.8**
L.S.D.	**n.s.**		**n.s.**
Mean	**381.8**	**413.0**	
L.S.D.p5%	**n.s.**		

Table 5.Effect of seed size and genotype on 300 seed weight (gm)

	S1(Lessthan7mm)	S2(Morethan7mm)	Mean
Hybrid	**76.0**	**79.33**	**77.67**
Inbred	**58.33**	**62.33**	**60.33**
L.S.D.	**n.s.**		**2.85**
Mean	**67.17**	**70.83**	
L.S.D.p 5%	**9.88**		

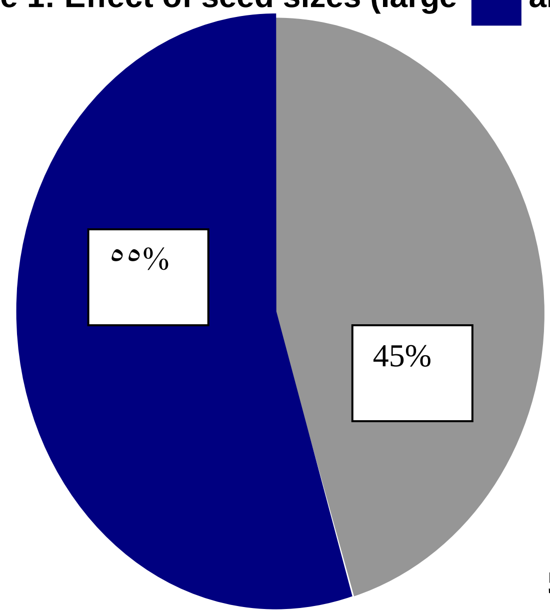
Table 6.Effect of seed size and genotype on seed yield (gm/upper ear)

	S1(Lessthan7mm)	S2(Morethan7mm)	Mean
Hybrid	**91.2**	**98.3**	**94.7**
Inbred	**66.2**	**75.7**	**71.0**
L.S.D.	**n.s.**		**6.92**
Mean	**78.7**	**87.0**	
L.S.D.p 5%	**6.92**		

Table 7.Effect of seed size and genotype on percentage of small seed (%)

	S1(Lessthan7mm)	S2(Morethan7mm)	Mean
Hybrid	**8.40**	**9.13**	**8.77**
Inbred	**27.07**	**33.70**	**30.38**
L.S.D.	**n.s.**		**3.28**
Mean	**17.73**	**21.42**	
L.S.D.p٥ %	**3.28**		

Figure 1: Effect of seed sizes (large and small) on Percentage of small seeds



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