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STUDY OF HETEROSIS IN MAIZE/ ARTICLE REVIEW

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ABSTRACT

Heterosis is a phenomena that have received the attention of geneticists and researchers in the field of plant breeding and improvement, in an attempt to find out the reasons for their occurrence, their rules and how to use them to improve plant characters and increase production. It is a phenomenon resulting from the interaction of genetic materials used by plant breeders in an appropriate manner to produce hybrids. The heterosis is at its peak in the first generation and then decreases in the later generations, as this phenomenon occurs in self and cross -pollinated, but it is more powerful and frequent in cross-pollinated plants, as they contain large genetic variance , and that this genetic mixing is the basis of their strength and vitality. The strength of heterosis is more pronounced when the genetic divergence between the parents involved in the hybridization is increased. In order to ensure obtaining high hybrid vigor, most sources refer to the introduction of parents with divergent genetic origins in the hybrid production programs.

INTRODUCTION

Maize (*Zea mays* L.) is a crop belonging to the Poaceae family and it comes in second place in terms of *i*mportance after wheat and first in terms of production, and third place in the Arab world after wheat and barley (Antar and Almashhadany, 2020 ; Alhamadany and Alrijabo, 2020) in terms of cultivated area (FAO, 2012). In Iraq the area cultivated for this crop reached 47785 thousand hectares, with a production of 46519 thousand tons of grain, with an average yield of 4535.2 k.g./hectare (Central Statistical Organization, 2018). Maize is used in human nutrition as well as a feed for poultry and livestock (White and Johnson, 2003).

Maize is distinguished from other cross-pollinated crops, with the ease of carrying outbreeding and *i*mprovement processes on it, especially hybridization, and the aim of it is to produce hybrids, which are characterized by having a better yield than the best parents involved in their production or the varieties approved in the region (AL-Sahuki, 1990). The process of a diallel cross between different parents is one of the most efficient mating systems in developing and evaluating individual hybrids, through which conclusions can be drawn about the nature of the Gene action, general and *s*pecific *c*ombining *a*bility and an estimate of some genetic parameters, through which to determine the best parental genetic combinations to produce the best hybrids, taking advantage of the phenomenon

of heterosis , which is the scientific basis for the production of these hybrids. The phenomenon of heterosis and hybrid *M*aize production is the greatest event in plant *b*reeding, which increased the interest of plant breeders in this crop and became the most favorable plant model in the development of breeding methods and genetic advance (AL-Dulaimi, 2004).

REVIEW THE REFERENCES

The discovery of the phenomenon of heterosis is a scientific revolution in the agricultural field (Mc Cann, 2005). Scientists East (1908) and Shull (1910) were the first to demonstrate the phenomenon of heterosis , which is defined as the increase in the size, weight, or growth rate of the resulting individual compared to his parents. Richey (1946) defined it as an increase in the growth of the hybrid over the parental rate. AL-Khishn and Khader (1977) defined it as an increase in the abundance of growth and yield and other quantitative characteristics compared to the best and mid parents. Al-Sahuki, *et al* (1983) used the term heterobeltiosis to measure the heterosis represented by the increase in the quality of the resulting hybrid compared to the better parent, and this phenomenon was used as a means of direct selection for the best hybrids.

There are several genetic actions that can be related to some or perhaps all of them to give the power of the heterosis (Fasoula and Fasoula, 1997) , which is the same that works in inbreeding. It was found in several different traits in the plant and seeds of this crop, such as the phenotypic and productive traits (Al-Sahuki, 1990). Kearsey and Pooni (1992) stated that the heterosis strength is not due to confusion or superiority, but because of the presence of dominant genes from the parents working towards one, and the strength of the heterosis is calculated based on the deviation of the hybrid from mid parents, better parent and a common commercial variety in the region. In general, from an economic point of view, the strength of the heterosis in improvement centers is compared to the better parent, and to a greater degree compared to a common commercial variety .

Numerous studies had been conducted on the phenomenon of heterosis in Maize , Ahmed (2003) obtained, when studying the characteristics of five pure strains of corn and their non-reversible crosses, a significant heterosis for the characteristics of G.Y.P. , N.G.R., E.W. , E.L , and 1000-G.W.. (80.615, 247.520, 91.715, 4.27, and 7.110), respectively , it varied in its significance for most of the traits, and there was a highly significant heterosis given by each camel for the G.Y.P. and the N.G.E..

Rezaei (2004) noticed, while studying ten pure strains of Maize and its half-reciprocal crosses, that the heterosis was significant and desirable in some crosses, for the N.G.R , P.H. and G.Y.P. . In a study conducted by Dawod *et. al.* (2009) for seven pure strains of Maize and its half-exchange hybrids, the percentage of hybrid vigor in (Research 106), ranged between (4.547 and 42.474) and (3.369 and 33.897) and (-0.083 and 11.396) in the two hybrids (Igr161 X OH40) and (W17 X B57), respectively, and four crosses gave a significantly higher G.Y.P. than the commercial variety are (W17 X B57) and (OH40 X B57)), (Igr181 X N28), and (OH40 X IK8).

Anees , (2010) showed when studying seven strains of corn and their non-reversible crosses and triple crosses resulting from them, that the heterosis measured on the basis of the best parents and on the basis of the commercial variety (Bahut 106) was significant and desirable for most single and triple crosses and for most traits, and the hybrids were distinguished Single (ZM7 × ZP), (W13R × Agr183), (Agr183 × ZP), (OH40 × ZM19R), (OH40 × ZP), and triple hybrids (ZM47W × (W13R × ZM 19 R), ZM47W × (Agr 183 × ZM) 19 R and (ZM47W × ZM 19 R) × OH40 with significant and desirable heterosis of the yield and its components. Amanullah *et. al.* (2011) studied the hybrid vigor measured on the basis of the best parents to cross six pure strains of Maize, as they obtained a heterosis for the yield trait significant in the desired direction in the crosses (S.whit x Sadaf), (Kisan x Azam) and (S). whit x Kisan) reached (4.83, 3.99, and 5.44), respectively. Al-Hamdani (2012) showed that the two hybrids (ZP-670 × ZP-505) and (ZP-707 × ZP-505) were given hybrid vigor and the desired direction for the characteristics of the N.D.F. , P.H. , G.Y.P. and O.R..

El-Badawy (2013) studied the heterosis of the hybrid in non-reversible cross-crossing between seven strains of Maize measured on the basis of two common commercial hybrids under two levels of nitrogen fertilizer, and noted that the hybrid (M9 x M39) gave the highest heterosis of the G.Y.E. measured on the basis of the commercial hybrid. Pioneer30k8 reached (21.34) and (8.16) for the two levels, respectively, while none of the hybrids achieved the desired heterosis compared to the commercial hybrid Hytech2031.

Hiremath *et. al.* (2013) indicated that when they studied fourteen pure strains of Maize and their cross-crosses, the heterosis measured on the basis of the best parents was significant in the desired direction for G.Y.E and N.D.F., and its highest values were (92.11%) and (-7.94%) respectively. Al-Qaisi (2013) studied the heterosis measured on the basis of the best parents of the non-reversible cross-hybrids between pure strains of Maize, and that the hybrids (IK-58×Un44052), (Un44052×R-153) and (Un44025×IK-8) gave significant and desirable heterosis of G.Y.E reached (85.74, 45.74 and 54.56), respectively. Ahmed (2013) introduced eight pure strains of yellow into a semi-reciprocal cross-hybrid *p*rogram to produce twenty-eight individual hybrids, and the parents and hybrids were planted on two dates (ideal and late) and found that the the heterosis of the G.Y.E measured on the basis of a commercial variety was significant and in the desired direction for seven crosses. , the hybrid P5 x P6 gave the heterosis of 16.89 in the normal time, while at the later date, the hybrid P1 x P5 gave the highest heterosis of 17.05.

Al-Bayati (2013) concluded, when studying ten pure strains of *M*aize, entered into a half-*c*ross-*c*rossbreeding program, that the hybrids (ZM47W×CML498), (CLO2720×CML495), (CLO2720×CML498) and (W13R× CML498) gave significant hybrid vigor. and desirable, measured on the basis of the best of the parents for most traits, including yield and its components. AL-Qasim (2014) introduced six pure strains of maize into a mid-cross-breeding program in the spring season 2012, and 15 individual hybrids were obtained, in the autumn season of the same year, all the genotypes achieved significant heterosis.

AL-Falahy *et. al.* (2014) indicated in a study conducted on six pure strains of Maize and all possible triple crosses between them, that there are significant differences between parents and triple crosses, and that the highest values in triple crosses were higher than those in parents and for most of the yield traits and components, This is evidence of a desirable hybrid vigor for these traits in many tertiary crosses. Al-Wardy (2017) Eight inbred lines of Maize derived from different genetic formulas were used in. These strains were introduced into the factorial hybridization program according to Comstcok and Robinson to devise individual hybrids, where prepared (INB-6, Pio-17, Syn – 9, M – 17) mothers, (PIO-3, S-10, mg– 1, AST-B) Parents for 16 individual hybrids , Estimates of hybrid vigor calculated compared with the best parents that hybrid (3 * 5 gave the highest percentage of hybrid vigor in G.Y.P. (33%).

Kanoush (2018) found when used on five cultivars of Maize in mid-cross cross-crossing and when studying the vigor of the hybrid that some of the hybrids were significant and desirable for the traits P.H., N.D.F. , N.G.R. and G.Y.E. in Maize.

Albadrani (2020) found in a study in which (5) pure strains of Maize were used with its ten crosses resulting from a half-cross cross-hybrid system without reverse crosses, that the crosses that gave the highest significant and desirable values for the most number of traits are (IK58 × Un44052), for the average of the two parents and the hybrid (Un44052 × Veges From pohene) for the best parents for the spring season, and the best hybrids that gave the highest moral and desirable values were the hybrid (IK58×Un44052) for the average parents and the most number of traits and the hybrid (IK58× DKcc6418) for the best parents for the most number of traits for the autumn season.

Whereas: (G.Y.P.) Grain.Yield /Plant^{-1}, (N.G.R.) No.of Grains.Row^{-1} , (E.W.) Ear.Weight , (E.L.) Ear.Length , 1000-G.W.) 1000-Grains.Weight , (N.G.E.) No.of Grains/Ear , (P.H.) Plant. Height , (N.D.F.) No.of Days.to Flowering , (O.R.) Oil. Ratio , (G.Y.E.) Grain. Yield /Ear , (N.G.E.) No.of Grains/Ear

CONCLUSION

The phenomenon of heterosis is useful for obtaining surpassed hybrids of Maize crop and the possibility of introducing these surpassed hybrids, especially for plant yield characteristic, in comparative experiments in different regions of the country.

دراسة قوة الهجين في الذرة الصفراء

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الخلاصة

تعد قوة الهجين من اهم الظواهر التي لفتت اهتمام وانتباه الكثيرين من علماء وباحثين ومشتغلين في مجال تربيه النباتات بمختلف انواعها بهدف تحسينها ، لمعرفة أسباب حدوثه ، وقواعده ، وكيفية الاستفادة منه في تحسين العمليات الانتاجية لمختلف المحاصيل نوعا وكما ، وهي ظاهرة ناتجة عن تفاعل

مواد وراثية نتجت في بيئات مختلفة يستخدمها مربي النبات بالشكل المناسب والافضل لإنتاج الهجن , وتكون قوة الهجين في ذروتها في افراد الجيل الأول الناتجة من عملية التضريب بين النباتات المختلفة ثم تتناقص وتتلاشى في الأجيـال اللاحقـة، حيث تحدث في جميع اجناس وعوائل النباتات متعددة التلقيح. بنوعيه، إلا أنها أكثر فعالية وتكرارًا في النباتات الملقحة الخليطة، حيث تمتلك اختلافات وراثية كبيرة ، وهذا الخليط من المورثات هو أساس القوة والحيوية لها. وتكون قوة. الهجين أكثر وضوحا عند زيادة التباعد. الوراثي بين الآباء الداخلة في التهجين. ولضمان الحصول على قوة هجين عالية ومتفوقة فإن أغلب المصادر تشير إلى ادخال آباء ذات أصول وراثية متباعدة في برامج انتاج الهجن.

الكلمات المفتاحية: قوة الهجين ، الذرة الصفراء ، تربية وتحسين النبات ، الاجيال ، التلقيح

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