

UDC 633.15: 633.52

© 2015

Dzlibetsky B.,

Academician of the NAAS, doctor of agricultural sciences

Fedko N., Bodenko N.,

Candidates of Agricultural Sciences State Institution Institute of Agriculture of the steppe zone of NAAS

Creation and assessment of new closed lines of com (*Zea mays* L.), related with genetic plasma Lancaster

The purpose. Creation of closed lines of com (*Zea mays* L.) of Lancaster heterosis group, meeting the requirements of modern selection programs.

Methods. Experimental and statistical.

Results. Results are given of probes carried out in 2009, 2011-2013 in creation on the basis of population DK296/680 of closed lines of corn. Such lines considerably exceed initial components on combining ability of «productivity of grain» and «harvest humidity of grain», and they also are characterized by high lodging resistance. Conclusions. Series of hybrids are selected which are better by a complex of attributes and exceed existing standards as to their grain productivity, harvest humidity and ecological integrity. Lines are received which are widely used at selection of hybrids FAO 300-500, adapted for various areas of Ukraine.

Key words: corn, closed line, genetic plasma, heterosis group, combining ability.

The effectiveness of modern corn selection determines the level of heterosis in hybrids, which is based on the concept of heterosis groups adopted in the breeding practice [5]. In the selection program of the DU Institute of Agriculture of the steppe zone of the National Academy of Sciences of the USSR, the most important heterosis group is Lancaster, whose lines are among the most successful commercial hybrids of our institution: Solonian 298SV, Monika 350MV, Khmel'nitsky, Zaporizhzhya 333MV, and others.

All modern self-pollinated lines of genetic plasma Lancaster originate from two lines of the first cycle Oh40B and C103 derived from Lancaster Surecrop self-pollination [9]. The most successful representatives of this heterosis group were the lines of the 2nd cycle Oh43 and Mo17, which were widely used in the world breeding programs. According to J.T. Gerdes and W.F. Tracy, already in the early 90's of the twentieth century. In the United States, derivatives of these lines represented 76% of the genetic plasma of Lancaster Surecrop in commercially available hybrids [4]. Similar data was reported by other researchers [3, 8]. However, the widespread use of the Oh43 and Mo17 lines has led to a significant modification of the Lancaster Surecrop heterozygous group. The study of the pedigree of these lines shows that they generally contain only 50% of the plasma genes of Lancaster Surecrop and 25% of the Reid Yellow Dent Plasma. So, most of the US-produced self-pollinated lines related to Lancaster Surecrop, at the end of the twentieth century. contained from 12.5 to 50% of the Lancaster Surecrop genome, indicating their considerable distance from the classical genetic plasma of Lancaster Surecrop [4].

This is primarily due to the propensity of the Lancaster plasma selection material to stem and root cavity. In order to get rid of these shortcomings, the Lancaster Surecrop lines crossed with the desired sources of other genetic plasmas and were selected to improve agronomic characteristics, while maintaining the potential of crop yields. However, it was not possible to completely eliminate the flaws, and therefore many modern Lancaster plasma inbred lines also have such problems. According to AF Troyer, the intrigue of insignificant DNA of the genetic plasma of Lancaster Surecrop can have a significant effect on the agronomic

productivity and the selective value of the genotype [10]. M.T. research results Jenkins indicate that 25% of the Oh43 and Mo17 lines in the hybrid genome are sufficient to increase heterosis on yield, and an increase in this proportion is undesirable due to stem quality problems [6]. It should be noted that the use of the lines of this group in the world breeding programs has recently decreased somewhat. Thus, the analysis of the genetic component of commercial hybrids, common in the US over the past 25 years, indicates that the genetic contribution of the inhomogeneous line Mo17 and its derivatives has decreased from 8.6 to 1.7%. Although the genetic component of the descendants of the Oh43 line, on the contrary, has grown to 3.9% [7]. At the Institute, Lancaster Oh43 and Mo17 plasma lines have been breeding for more than 40 years, and the number of FAO hybrids > 300, created for their participation in the control seedlings for testing maize hybrids in different years, reaches 67-75%. The most successful heterosystem model is Iodent × Lancaster [1, 2], and the overall use of the lines of this heterosis group in the competitive varietal testing of mid-late hybrids reaches 43%.

The purpose of the research is the creation of inbred lines of maize (*Zea mays* L.) heterozygous Lancaster with high combining ability and resistance to sinking, intense moisture loss of grain that would meet all the requirements of modern breeding programs. Research methodology. The research was carried out in the experimental farm "Dnipro" of the Institute of Agriculture of the steppe zone of NAAS in 2009, 2011 - 2013.

The source material was self-pollinated lines of corn (*Zea mays* L.) generations S4-S6, selected from the population DK296 / 680, created with the participation of lines Genetic Plasma Mo17 and Oh43. Inbred lines and their test crops were grown in breeding and control nurseries. The size of the plots is 4.9 m², the repetition is 3 times with renaming for repetitions. The plant density was formed in the phase of 4-5 leaves and amounted to 55 thousand plants per hectare.

The experiments were carried out in accordance with the "Methodology of state variety testing of agricultural crops" (2001) and "Methodological recommendations for conducting field experiments with corn" (1980). The statistical validity of experimental data was determined (BA Armor, 1985), variation parameters (GF Lakin, 1990), and the estimation of the parameters of combining ability in the system of incomplete test-crossing crossings (GK Dremlyuk, VF Gerasimenko, 1991).

Hydrothermal conditions in 2009 were dry, the average amount of precipitation from April to September was 76.8% of the norm during this period. The temperature regime fluctuated strongly - from cold spring to extremely hot in July - August. The most favorable was in 2011, with dry conditions during the stairs and the first half of the growing season, but from the beginning of July there were periodic precipitation and moderate temperatures, which allowed corn to form a record harvest. Weather conditions in 2012 were the most stressful for corn and were characterized by high air temperatures and insignificant rainfall during the growing season, which led to an unprecedented low yield of grain, and 2013 can be considered a good year for corn. The beginning of vegetation was characterized by a rapid increase in the sum of effective temperatures, which allowed maize to reduce the period of ontogenesis for 7 - 10 days, and a fairly even distribution of precipitation during intensive water consumption and infusion - to form a high grain yield.

Research results and their discussion. The initial population is based on the simple hybrid DK296 × DK680 in 2006. Parental lines DK296 and DK680 belong to the Lancaster heterozygous group. The inverted line DK296 combines in its genome two main branches of this plasma - Oh43 and Mo17, but morphological and breeding grounds closer to the Mo17 group. The DK680 inbred line is derived from a complex heterogeneous population, the main components of which originate from the plasma Lancaster Oh43.

Initial parent lines were characterized by high combining ability, morpho-biological and economically valuable indicators. The main focus of our research was to obtain faster-than-inbred lines of inbred lines,

with higher combining ability and more intensive loss of moisture in the grain. We paid particular attention to the selection of genotypes with high resistance to shedding and high grain yield. During 2005-2007, about 80 recombinant genera S1-S3 were received and evaluated for morphological and biological characteristics, and from the generation S4 in 2008, testing of self-pollinated families was started according to the scheme of the toplus.

During the research, the best conditions for the growth and development of corn were in 2011, when the average yield of test krosas of the group of inbred families DK296 / 680 amounted to 11 t / ha for the average grain moisture content of 16.4% (tab. 1).

The selection of the intensity of moisture loss during the ripening of grain and the level of grain productivity in the complex, with other estimates, contributed to the gradual increase of the yield / moisture ratio in the test krosas of the DK296 / 680 group of recombinant species compared to the standards of 0.36 and 0.42 in 2009 p. to 0.43 and 0.37 in 2013, which testifies to the effectiveness of such an approach.

Selection also affected the variation of grain yield and grain moisture content in the test kernels, which in the initial 2009 had average values of these indicators, respectively, 1 and 25.7% lower than the best standard, and in 2013, by contrast, by yield already exceeded them by 20,3% (1,45 t / ha).

With each new selection cycle, the breeders face the problem of continuous improvement of the source material by the way of integrating into high-overall combining ability lines (GKZ). The presence of only a high specific combination ability for certain groups of testers reduces the effectiveness of the selection, since it is ultimately directed only to a very limited number of potentially successful combinations [11]. In our research, the highest CKD for the "grain yield" indicator was found by self-pollinated families DK296 / 680 2231, DK296 / 680 1111 and DK296 / 680 2132, which in 2013 had the constants of KZK effects at 0.94 t / ha, 0,63 and 0,62 t / ha respectively (Table 2).

It should be noted that during the first stages of testing in 2009, the recombinant substances for the "grain yield" sign have kept it high in the following generations. In 2013, all the best self-infected families had a higher class of skin effects compared to the standard - the DK296 line, which had an estimate of -1.43 t/ha and conditionally enrolled in the 3rd lowest class of estimates.

Selection of specific hybrid combinations is the ultimate goal of any breeding program. Such genotypes should be the best in a set of features and exceed the existing standards for performance, harvest humidity and environmental sustainability. In our research, the most successful hybrids are the test crops (DK744M × DK301) × DK296 / 680 2132 and (DK744M × DK301) × DK296 / 680 2231 with a yield of 10.40 and 10.28 t / ha respectively in 2013 (Table 3)

The grain yield and harvest humidity ratio is now quite a demonstrative and convenient indicator that can make the most rational choice of the hybrid, capable of satisfying the needs of the production by a successful combination of high productivity and minimum costs of pre-harvesting. The most valuable of this criterion are combinations (DK744M × DK301) × DK296 / 680 2132 and (DK744M × DK216) × DK296 / 680 2231 in which it was 0.54 and which combine grain yields of 10.40 and 10.11 tons / ha and harvesting moisture content of grain is 19.4 and 18.8% respectively, which is better than the best standard hybrid for this indicator (figure).

Conclusions

As a result of the research conducted on the basis of the population DK296 / 680 lines were obtained that significantly outweigh the original components by their combined ability in terms of "grain yield" and "harvest

moisture content of grain", and also characterized by high resistance to sinking. They are widely used in the selection of hybrids of the middle and middle-aged ripeness groups adapted for different zones of Ukraine.

Bibliography

1. Dzyubetsky B.V. Results of ecological varietal testing of mid-late and mid-late hybrids of maize of different types and heterozosis models / B.V. Dzyubetsky, MM Fedko, L.A. Ilchenko // Irrigation Agriculture: Sb. sciences works. - Kherson: Ayalant, 2013. - Vip. 59. - pp. 143 - 146.
2. Fedkov MM Selection of medium late FAO> 400 maize hybrids (Zea maize L.) for high adaptive capacity and ecological stability / MM. Fedko // Byul. Institute of Agriculture of the steppe zone of NAAS. - Dnipropetrovsk: New Ideology, 2013. - No. 5. - S. 26 - 31.
3. Anonymous. MBS Inc. genetics handbook/Anonymous// 18th ed. MBS, Inc., Ames, IA. - 1991. — 86 p.
4. Gerdes J.T. Pedigree diversity within the Lancaster Surecrop heterotic group of maize/J.T. Gerdes, W.F. Trasy//Crop Sci. — 1993. — V. 33. — P. 334 – 337.
5. Hallauer A.R. Corn Breeding/A.R. Hallauer, W.A. Russell, K.R. Lamkey//G.F. Sprague, J.W. Dudley (ed.). Corn and corn improvement. 3rd ed. ASA, CSSA, and SSSA, Madison, WI., 1988. — P. 469 – 564.
6. Jenkins M.T. Maize breeding during the development and early years of hybrid maize/M. T. Jenkins//D.B. Walden (ed.). Maize breeding and genetics. John Wiley & Sons, New York, 1978. — P. 13 -28.
7. Mikel M.A. Genetic composition of contemporary U.S. commercial dent corn germplasm/M.A. Mikel// Crop Sci. — 2011. — V. 51. — P. 592 – 599.
8. Smith J.S.C. Diversity of United States hybrid maize germplasm: Isozymic and chromatographic evidence/J.S.C. Smith//Crop Sci. — 1988. — V. 28. — P. 63 – 69.
9. Smith J.S.C. Genetic variability within U.S. maize germplasm: I. Historically important lines/J.S.C. Smith, M.M. Goodman, C.W. Stuber//Crop Sci. — 1985. — V. 25. — P. 550 – 555.
10. Troyer A.F. Adaptedness and heterosis in corn and mule hybrids/A.F. Troyer//Crop Sci. — 2006. — V. 46. — P. 528 – 543.
11. Troyer A.F. Temperate corn — Background, behavior, and breeding/A.F. Troyer//A.R. Hallauer (ed.). Specialty corns. 2nd ed. CRC Press, Boca Raton, FL. — 2000. — P. 393 – 466.

Released to 25.11.2014