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THE COMBINATION ABILITY TO SELF-POLLINATING MAIZE LINES IN BREEDING FOR COLD RESISTENCE IN A NORTHERN FOREST-STEPPE UKRAINE

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Studied ability self-pollinating maize lines in the system incomplete dialelnyh crosses. The best one for general and specific Raman line resolution and obtained hybrids with high display signs of "productivity", suitable for early sowing, which can be used in future breeding studies.

Key words: *self-pollinating line, hybrid, combination ability, corn, cold, effects ZCP and SSI, heterosis, environmental testing, dialelni crossing.*

Corn is a tropical crop with low tolerance to low temperatures (below + 10 °C). Culture was introduced to southern Europe from tropical regions of America and only later adapted to the conditions of the northern regions. Moving from the southern regions in the north, it passed the natural and artificial selection vegetations and adaptation to the cold temperatures. However, none of the hybrids is not fully resistant to low temperatures and usually has a low yield [1]. At the same time, most crymophylactic populations have favorable alleles useful for increasing resistant to cold.

The level of yield corn hybrids, today, reaches 14-16 t / ha even in the area of northern steppes. However, in the area of Polesie level of productivity hybrids significantly lower, primarily due to the instability of weather conditions in the spring and there is always the risk of lowering the temperature to 0°C and below after sowing, which adversely affect the growing thermophilic corn hybrids, especially in waterlogged soils. It is all prevents the potential disclosure of such hybrids.

The successful for growing corn and a guaranteed friendly stairs in this area are hybrids for sowing crymophylactic average temperature of the soil at a depth of

seeding + 6-7 °C. Early sowing in hybrids not resistant to cold extended period "sowing-ladder" that adversely affects the defeat of mold diseases, reduces germination and initial growth energy. By late sowing in the region, there is risk of uneven stairs, through the sowing of "overdried" soil, and the number of hybrids that could be sown for a temperature limited, which reduces accordingly the disclosure of their potential in the region.

Breeding corn associated with genetic selection plasma, materials which are able to grow at low temperatures and have a high energy initial growth [2]. Several authors have identified genotypes suitable for growing corn in low temperature conditions [3-4], but cold resistance in elite genetic plasma (Lancaster Ayodent) is limited and favorable resistance genes difficult to identify [2,4]. Theoretically genetic plasma originating from northern latitudes, such as Lakaune shall form higher yields in regions with short growing period.

To create hybrids with high cold resistance and high yield requires a selection of original material that had these characteristics and skills matching his abilities. That is, knowledge of the nature of inheritance of these traits is the guarantee of hybrid combinations which determine the relevance of the work in this direction.

The aim of research was to determine similarities and energy friendliness stairs initial growth of hybrids derived from crosses scheme parent dialelnyh their early sowing (at + 6 °C at a depth of seeding); determine the total (ZCP) and specific (SSI) combining ability on the basis of "productivity" in the leased lines self-pollinating corn, which is the basis of contrasting "cold resistance"; vidilyty most productive cold-resistant hybrids for further research.

To achieve the goal were as follows: obtain hybrids between contrasting the basis of "cold resistance" self-pollinating corn lines; identify similarities, friendliness and energy stairs initial growth of hybrids obtained by early sowing; an analysis of general and specific combining ability; select hybrid combinations that have the best performance on the basis of "cold resistance" and have a high level of productivity.

The material given in (table 1), were selected by the analysis of 108 lines of different genetic origin with varying degrees resistant to cold, laboratory and field methods. Laboratory method was to seed germination temperature of + 10 ° C for 20 days and then conducted prolonged growth at + 25 ° C for 3 days. Optimal germination was conducted at + 25 ° C for 3 days. Also, material studies were 45 hybrids obtained by crossing scheme parent dialelnyh crosses.

Table 1

Similarity self-pollinating lines for optimal germination and cold

Name of line	Country of origin	The similarity in germination,%	
		Optimal	Cold
HLG 1203	Ukraine	98,3	98,3
HLG 1238	Ukraine	100,0	100,0
FV 243	Russia	98,6	95,0
Q 170	Canada	100,0	91,7
CO 255	Canada	100,0	100,0
UCH 37	Ukraine	98,3	98,3
Ak 135	Ukraine	100,0	98,3
F 2	France	92,0	76,7
P 165	USA	100,0	58,3
L 155	USA	98,5	56,1

Field studies were conducted in 2009-2011. In the fields laboratory of selection and genetics NUBiP Ukraine in. Wheat, Vasylkiv district, Kyiv region. The soil cover areas of a typical conventional humus and black earth. Land area accounting for 4.9 m² self-pollinating lines and 9.8 m² for hybrids, according to "Methodical recommendations of field and laboratory study of maize genetic resources" [5]. Repeated 4 single location with rendomizovanym sites.

In field sowing was carried out on varying soil temperature at a depth of seeding. The first term of sowing on soil temperature + 6-6,5 ° C, the second + 8,0-8,5 ° C and a third + 10,0-10,5 ° C (control).

During the investigation conducted determining signs of "vigor", "friendliness stairs", "field and laboratory similarities" and "productivity."

Analysis of combining ability was performed using Exel according to guidelines [6]. Analysis of variance was performed under the scheme parent dialelnyh crosses for fourth method Hriffinha for "yield" based on the results of field testing of hybrids. To account taken yield results for the first term sowing + 6-6,5 ° C because at this temperature sowing makes it possible to identify cold-resistant hybrids.

For the environmental test hybrids were sown in three locations: 1. In the fields laboratory of plant breeding and genetics NUBiP Ukraine in. Wheat, Vasylkiv district, Kyiv region; 2. In the fields of laboratory and animal feed production Chernigov Institute APV, p. Chemer, Kozeletskyi district, Chernihiv region 3. In the fields of laboratory breeding and seed corn Selection and Genetics Institute in the village. Novoselytsia, Kotovsky district, Odessa region.

According to the results of field studies Field similarities highest rates for early sowing (+ 6-6,5 ° C) was observed in hybrids, which are composed of one or two cold-resistant lines (Table 2).

Table 2

Similarity, friendliness and energy stairs initial growth of the best hybrids for sowing early (+ 6-6,5 ° C), 2011

Hybrid	Field germination,%	Friendliness stairs, score	Energy initial growth, score
Остер СВ ст.	62,5	5	5
FV 243/HLG 1203	73,8	5	5
Q 170/HLG 1238	73,8	7	7
Q 170/FV 243	79,4	7	7
CO 255/HLG 1203	82,5	7	7
CO 255/HLG 1238	87,5	9	7
CO 255/FV 243	84,4	9	7
CO 255/Q 170	82,5	9	7
AK 135/FV 243	74,4	5	5
AK 135/Q 170	73,1	5	5
F 2/HLG 1238	73,8	5	5
F 2/FV 243	79,4	5	5
P165/Co 255	70,0	7	5
L 155/ Co 255	68,1	5	5
L 155/HLG 1203	73,8	5	5
L 155/UCH 37	72,5	5	5
L 155/F 2	76,3	3	3

Highest stairs friendliness, energy and initial growth showed similarity hybrids, the parent component which has been cold-Line SB 255 Canadian origin. The similarity of their varied within 82,5-87,5% by early sowing, and the friendliness of stairs was 9 points, and the energy of the initial growth - 7. high field germination was observed in hybrid combinations of F 2 / FV 243 - 79.4% and 155 L / F 2 - 76.3%. It should be noted that their parental components were: one line not resistant to cold L 155 - American origin and French origin line with the average cold resistance - F2. In terms of "field resemblance" all hybrids exceeded the standard Oster ST.

The yield of hybrids depend not only on similarities but also on combining ability of certain genotypes. For example, some high yield hybrids formed by high similarity, and others, even in reduced germination had a high level of heterosis, which had a positive impact on productivity and ZCP effects (Table 3).

Table 3:

Yields (t / ha) and effects ZCP self-pollinating maize lines

♀\♂	L 155	P165	F2	Ak 135	UCH 37	Co 255	Q 170	FV 243	HLG 1238	HLG 1203	Сум. Xi	$(Xi)^2$	Ефекти ЗКЗ
L 155		4,8	7,8	7,6	8,0	8,3	6,8	7,2	6,6	9,0	66	4364	1,45
P 165			5,2	6,7	6,1	8,1	5,6	7,2	5,9	6,7	56	3157	0,22
F 2				5,7	5,1	5,7	3,9	5,1	4,3	4,4	47	2209	-0,93
Ak 135					4,6	7,3	5,6	6,9	5,5	4,8	55	2984	0,02
UCH 37						6,7	4,4	6,4	4,4	5,1	51	2577	-0,46
Co 255							7,5	8,8	8,1	4,9	65	4286	1,38
Q 170								6,0	5,6	3,8	49	2412	-0,67
FV 243									5,2	5,8	58	3416	0,50
HLG 1238										3,4	49	2393	-0,69
HLG 1203											48	2280	-0,84
$HIP_{0,05}$													0,28

The highest ZCP observed in lines L 155, CO 255, FV 243 - 0,50-1,45. This means that the use of data lines as parental components makes it possible to improve the yield of hybrids due to higher heterosis effect. The average level observed in ZCP lines P165, Ak 135 - 0.22 - 0.02. These lines are allocated an

average heterosis effect, but the optimal combination of parental components (high SSI) can form hybrids with high yield.

Despite the high level of ZCP self-pollinating lines of maize hybrids with the selection of the simple yield on the most important indicator is the specific combination of resolution (SSI), the ability to produce offspring in vykoheterozysne certain specific crossings. The effects of SSI on the basis of "productivity" and actual yield corn hybrids in terms of basic moisture in the system are incomplete dialelnyh crosses in (Table 4).

Table 4

Effects SSI and actual yield corn hybrids newly crymophylactic

Hybrid	SSI Effects	Productivity, t / ha
Q 170 / HLG 1238	0,87	5,6
Co 255 / Q 170	0,79	7,5
Co 255 / FV 243	0,87	8,8
Co 255 / HLG 1238	1,39	8,1
F2 / Ak 135	0,44	5,7
P 165 / Co 255	0,45	8,1
P 165 / HLG 1203	1,22	6,7
L 155 / Co 255	-0,59	8,3
L 155 / F2	1,18	7,8
L 155 / UCH 37	0,98	8,0
L 155 /HLG 1203	2,31	9,0
$HIP_{0,05}$	0,47	0,70

The highest specific combining ability was observed in hybrids: L 155 / HLG 1203, L 155 / F2, Co 255 / HLG 1238, L 155 / UCH 37 - 0,98-2,31, whose yield was 7.8 - 9.0 t / ha in terms of basic humidity. Hybrids, which was the parent component self-pollinating line L 155, revealed its potential due to high combining ability, although the similarity was not highest. Hybrid Co 255 / HLG 1238 formed a high yield due to the high specific combining ability and high cold-resistant hybrids., and accordingly the similarity. Also, a high level of productivity observed in hybrid Co 255 / FV 243, which is at a relatively lower SSI (0.87), due to the high similarity shaped yield 8.8 t / ha. High yield and distinguished hybrids that have high SSI (P 165 hybrid / Co 255 - 0.45) and even lower SSI (155 Hybrid L /

Co 255 - -0.59) and relatively low similarity (68,1-70, 0%) yield which was 8.1 and 8.3 t / ha, respectively.

An important element of the assessment values and plasticity hybrids are tested in different climatic zones of Ukraine. For this purpose, conducted environmental testing of newly created hybrids in Chernihiv (Polesie), Kiev (North steppe) and Odessa (transition zone from steppe to forest steppe) regions.

This test made it possible to identify a single year hybrids with different response to the growing conditions, that is, the opportunity to determine their phenotypic stability (Table 5).

Table 5

Yield the best hybrid combinations in environmental testing, t / ha (2011)

Hybrid	Productivity, t / ha							
	Chemer	+/- to Art	Kyiv	+/- to Art	Kotovs'k	+/- to Art	Finished on 3 locations	+/- standard on 3 locations
Q 170/HLG 1203	5,6	-1,5	3,8	-2,7	3,2	-1,5	4,2	-1,9
CO 255/HLG 1203	6,0	-1,1	4,9	-1,6	3,4	-1,3	4,8	-1,3
CO 255/Q 170	4,7	-2,4	7,5	1,0	3,4	-1,3	5,2	-0,9
AK 135/HLG 1203	5,0	-2,1	4,8	-1,7	4,0	-0,7	4,6	-1,5
AK 135/Q 170	5,8	-1,3	5,6	-0,9	3,9	-0,8	5,1	-1,0
F 2/HLG 1203	4,0	-3,1	4,4	-2,1	3,6	-1,1	4,0	-2,1
P 165/CO 255	6,7	-0,4	8,1	1,6	6,0	1,3	6,9	0,8
P 165/F 2	5,8	-1,3	5,2	-1,3	3,2	-1,5	4,7	-1,4
L 155/Q 170	5,8	-1,3	6,8	0,3	4,8	0,1	5,8	-0,3
L 155/CO 255	7,7	0,6	8,3	1,8	5,1	0,4	7,0	0,9
L 155/F 2	6,8	-0,3	7,8	1,3	5,2	0,5	6,6	0,5
Остер ст.	7,1		6,5		4,7		6,1	-
НІР $_{0,05}$	0,65		0,72		0,41		0,59	-

In northern locations (Polesie) highest yield hybrids formed L 155 / CO 255, L 155 / F 2 and P 165 / CO 255 - 6,7-7,7 t / ha. In the northern forest - hybrids L 155 / CO 255, P 165 / CO 255, L 155 / F 2 and CO 255/ Q 170 - 7,5-8,3 t / ha, which exceeded the standard on the 1.0 - 1, 8 t / ha. In extreme southern location

(transition zone to the forest-steppe Steppe) highest yield hybrids formed L 155 / F and P 165 2 / CO 255 - 5,2-6,0 t / ha.

The highest yield in all three locations was observed in the hybrid L 155 / CO 255 (average yield of 7.0 t / ha), which exceeded the standard on 0.9 t / ha. At the level of the standard yield hybrid formed - L 155 / F 2 - 6.6 t / ha. The highest yield in two locations (Kyiv, Kotovsk) and at the level of standard in hybrids demonstrated Chemeri 155 L / F and P 165 2 / CO 255. However, their average yield was higher than the standard 0.5 and 0.8 t / ha respectively.

These figures are high heterosis effect was achieved primarily by gaining high similarity data hybrids, which was inherited from the Co 255 and F2 self-pollinating lines. Lines L 155, P 165 at low holodostiykosti have high effects ZCP and SSI, as seen during mating scheme parent dialelnyh crosses.

These hybrids are characterized by high stability and suitable for growing in different soil-climatic zones and are recommended for early sowing dates. Under these conditions the best they reveal their genetic potential. Lines - Co 255, Q 170, HLG 1238 can be recommended for use as a source (donor) increase resistant to cold.

future hybrid. Lines - L 155, P 165 and F2 - use to improve heterosis and receiving a high level of productivity. With this combination (cold-lines and lines with a high effect ZCP) can be obtained consistently high yields in different soil and climatic conditions.

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