KƏND VƏ MEŞƏ TƏSƏRRÜFATI AGRICULTURE AND FORESTRY СЕЛЬСКОЕ И ЛЕСНОЕ ХОЗЯЙСТВО

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STUDYING THE TRANSGRESSIVE VARIABILITY OF QUANTITATIVE CHARACTERISTICS IN THE SECOND GENERATION HYBRIDS OF WINTER BREAD WHEAT

Keywords: *breeding, bread wheat, transgressive variability, variety, combination, hybrid, selection, parental form*
Ключевые слова: *селекция, мягкая пшеница, трансгрессивная изменчивость, сорт, комбинация, гибрид, селекция, родительская форма*

Introduction: To study the regularities in the inheritance of quantitative and qualitative traits during hybridization is known to be necessary for improving the effectiveness of the selection process. It should be noted that the possibility of the differentiation of individuals with positive transgressive traits, which do not manifest themselves in F_1 hybrids, decreases in F_2 hybrids. According to some authors, extensive phenotypic variations in quantitative traits occur in the hybrid combinations of the second generation (F_2). As a result, depending on the genetic hereditary factors of the components involved in the hybridization, differentiation of the phenotypic dominance rate in the obtained hybrid combinations was observed [1; 2; 3; 6].

Thus, one of the most important issues is the proper selection of the parents that would result in the increase of the hybridization efficiency, high heterosis in the first (F_1) and second (F_2) generation hybrids and positive transgressive traits in the second (F_2) generation hybrids [4; 5].

Materials and methods: The research was performed in the Terter Regional Experimental Station of the Research Institute of Crop Husbandry under irrigated conditions in 2014-2015. The objects of the study were the second generation (F_2) hybrid combinations produced by the interspecies hybridization of autumn bread wheat (total 38 combinations). The structural analysis of these hybrid combinations and parental forms was performed. Transgression rate and frequency in the quantitative traits were calculated and genetic parameters (transgression frequency and level) for revealing traits were determined.

The structural elements of the production were studied considering the methodical instructions (*A.S.Musayev, H.S.Huseynov, Z.A.Mammadov*) [7]. Transgressive variability for the quantitative traits in the second generation hybrids (F_2) was calculated according to the method by G.S. Voskresenskaya and V.I. Shpota (1967) [8].

Results: During the research performed in 2014-2015, positive transgression in plant height was revealed in 50% (19 hybrids) and negative transgression in 50% (19 hybrids) of the combinations out of 38 second generation (F_2) hybrids. The lowest transgression rates in plant height were found in the combinations: TT 01329 Sonmez x Doka (Tgs= -21.67%), TT 01328 Doka x Azeri (Tgs= -20.35%), TT 01327 Doka x Pervin (Tgs= -20.09%) (Table 1).

Table 1.
The second generation (F_2) of bread wheat hybrid combinations with low transgression rate in plant height

Combinations	Plant height, cm			Tgs
	♀	F_2	♂	
2	*3*	*4*	*5*	*6*
TT 01302 Murov-2 x Doka	120.7	132.3	152.3	-13.13
TT 01305 Murov-2 x Shefeg-2	120.7	110.0	120.3	-8.86
TT 01307 Shefeg-2 x Doka	120.3	129.0	152.3	-15.30
TT 01314 Azeri x Doka	118.0	135.7	152.3	-10.90
TT 01318 Murov x Doka	118.3	128.0	152.3	-15.95
TT 01326 Doka x Shefeg-2	152.3	123.7	120.3	-18.78
TT 01327 Doka x Pervin	152.3	121.7	120.3	-20.09

TT 01328 Doka x Azeri	152.3	121.3	118.0	-20.35
TT 01329 Sonmez x Doka	123.3	119.3	152.3	-21.67
TT 01332 Sonmez x Trap	123.3	114.3	99.3	-7.30
TT 01351 Z 2009/1-1 (Aran x Umanka) x Pervin	117.3	110.7	120.3	-7.98

Plant height in parental forms was found to be 99.3-152.3 cm, whereas in the second generation (F_2) of the hybrid combinations this parameter was in the range of 110.0-142.0 cm. Short stature dominates in 4 hybrid combinations out of the studied 38 ones and intermediate heredity was observed in 19 hybrid combinations.

Positive transgression in ear length was found in 32 hybrids (84.21%) and negative transgression in 6 hybrids (15.79%) out of 38 second generation (F_2) hybrids. The highest transgression levels in ear length were found in the combinations: TT 01318 Murov x Doka (Tgs= +21.95%), TT 01316 Murov x Bezostaya-1 (Tgs= +16.26%), TT 01343 TT 09214/3-1 lutessens x Tanya (Tgs= +11.92%), TT 01352 Z 2009/2-1(Murov x Aran) x Bezostaya-1 (Tgs= +11.14%), TT 01334 Sonmez x Pervin (Tgs= +9.07%) (Table 2).

Table 2.

Combinations with high transgression rates in ear length in the second generation (F_2) of the bread wheat hybrid combinations

Combinations	Ear length, cm			Tgs
	♀	F_2	♂	
2	*3*	*4*	*5*	*6*
TT 01301 Murov-2 x Bezostaya-1	13.3	14.0	12.3	+5.26
TT 01302 Murov-2 x Doka	13.3	14.67	13.67	+7.31
TT 01304 Murov-2 x Tanya	13.3	14.17	13.0	+6.54
TT 01305 Murov-2 x Shefeg-2	13.3	16.67	15.67	+6.38
TT 01316 Murov x Bezostaya-1	12.3	14.3	12.3	+16.26
TT 01317 Murov x Tanya	12.3	14.0	13.0	+7.69
TT 01318 Murov x Doka	12.3	16.67	13.67	+21.95
TT 01327 Doka x Pervin	13.67	15.0	14.0	+7.14
TT 01334 Sonmez x Pervin	14.67	16.0	14.0	+9.07
TT 01339 TT 09214/3 lutessens x Vassa	13.3	16.3	15.0	+8.67
TT 01343 TT 09214/3-1 lutessens x Tanya	13.67	15.3	13.0	+11.92
TT 01345 TT 09214/3-1 lutessens x Trap	13.67	14.67	12.67	+7.31
TT 01352 Z 2009/2-1(Murov x Aran) x Bezostaya-1	10.3	13.67	12.3	+11.14
TT 01353 Z 2009/2-1 (Murov x Aran) x Sonmez	10.3	15.67	14.67	+6.82
TT 01356 Z 2009/2-1 (Murov x Aran) x Pervin	10.3	15.17	14.0	+8.36

In the parental forms this trait changed in the range of 10.3-16.0 cm, whereas in the second generation (F_2) of the hybrid combinations this parameter changed from 13.0 to 16.67 cm. In 32 hybrid combinations out of the studied 38 ones, ears were longer compared with the parental forms.

Depending on the combinations in F_2 hybrids, transgression frequency in ear length changed from 10.0% to 100.0%. Transgression frequency in ear length of the second generation (F_2) of bread wheat hybrid combinations (38 combinations) was as follows: in 3 combinations 10%, in 1 combination 20%, in 9 combinations 30%, in 4 combinations 40%, in 3 combinations 50%, in 5 combinations 60%, in 3 combinations 70%, in 2 combinations 80%, in 1 combination 90%, in 1 combination 100% and in 6 combinations 0%. The combinations TT 01316 Murov x Bezostaya-1 (100%), TT 01352 Z 2009/2-1 (Murov x Aran) x Bezostaya-1 (90%), TT 01318 Murov x Doka (80%), TT 01334 Sonmez x Pervin (80%) were distinguished by high parameters.

Based on the number of grains per ear, positive transgression occurred in 20 (52.63%) and negative transgression in 18 (47.37%) out of the studied 38 second generation (F_2) hybrids. The combinations TT 01334 Sonmez x Pervin (Tgs= +32.83%), TT 01343 TT 09214/3-1 lutessens x Tanya (Tgs= +24.77%), TT 01317 Murov x Tanya (Tgs= +20.70%), TT 01310 Shefeg-2 x Vassa (Tgs= +18.95%) had the highest transgression levels (Table 3).

Table 3.
Combinations with high transgression rates in the grain number per ear in the second generation (F_2) hybrids of bread wheat

Combinations	The num. of grains per ear			Tgs
	♀	F_2	♂	
2	*3*	*4*	*5*	*6*
TT 01304 Murov-2 x Tanya	55.0	63.0	47.0	+14.54
TT 01310 Shefeg-2 x Vassa	72.3	86.0	68.0	+18.95
TT 01317 Murov x Tanya	48.3	58.3	47.0	+20.70
TT 01321 Tereggi x Pervin	61.67	71.67	64.0	+11.98
TT 01334 Sonmez x Pervin	66.0	87.67	64.0	+32.83
TT 01336 Alman x Sonmez	61.3	71.3	66.0	+8.03
TT 01339 TT 09214/3 lutessens x Vassa	62.0	79.0	68.0	+16.18
TT 01343 TT 09214/3-1 lutessens x Tanya	55.3	69.0	47.0	+24.77
TT 01345 TT 09214/3-1 lutessens x Trap	55.3	65.0	49.0	+17.54
TT 01352 Z 2009/2-1(Murov x Aran) x Bezos.1	48.3	57.0	53.67	+6.20
TT 01356 Z 2009/2-1 (Murov x Aran) x Pervin	48.3	71.3	64.0	+11.41

Thus, this trait ranged from 47.0 to 92.0 in parental forms, whereas in the second generation (F_2) hybrid combinations it changed in the range 53.67-87.67. In 20 hybrid combinations, out of 38 studied hybrids, the number of grains per ear was found to be larger compared with the parental forms.

Transgression frequency in the number of grains per ear in the second generation (F_2) hybrid combinations of bread wheat ranged from 20.0% to 90.0%. Transgression frequency in the number of grains per ear in the second generation (F_2) of bread wheat hybrid combinations (total 38) was as follows: in 1 combination 20%, in 4 combinations 30%, in 4 combinations 40%, in 4 combinations 50%, in 2 combinations 60%, in 1 combination 70%, in 1 combination 80%, in 3 combinations 90%, in 18 combinations 0%. The combinations TT 01317 Murov x Tanya (90%), TT 01343 TT 09214/3-1 lutessens x Tanya (90%), TT 01345 TT 09214/3-1 lutessens x Trap (90%) were distinguished by their high indices.

Positive transgression in the mass of grains per ear was observed in 71.05% of the hybrid combinations (27 hybrids), whereas negative transgression occurred in 28.95% (11 hybrids) of the combinations out of the studied 38 hybrids in 2014-2015. The highest transgression level in the mass of grains per ear was observed in the combinations TT 01316 Murov x Bezostaya-1 (Tgs= +49.80%), TT 01317 Murov x Tanya (Tgs= +32.71%), TT 01310 Shefeg-2 x Vassa (Tgs= +19.13%) (Table 4).

Table 4.
The second generations (F_2) of bread wheat combinations with high transgression rate in the mass of grains per ear

Combinations	Grain mass per ear, g.			Tgs
	♀	F_2	♂	
2	*3*	*4*	*5*	*6*
TT 01303 Murov-2 x Vassa	2.33	3.50	3.03	+15.51
TT 01304 Murov-2 x Tanya	2.33	2.54	1.99	+9.01
TT 01310 Shefeg-2 x Vassa	3.66	4.36	3.03	+19.13
TT 01316 Murov x Bezostaya-1	2.14	3.73	2.49	+49.80
TT 01317 Murov x Tanya	2.14	2.84	1.99	+32.71
TT 01321 Tereggi x Pervin	2.73	3.13	2.78	+12.59
TT 01327 Doka x Pervin	3.55	4.01	2.78	+12.96
TT 01334 Sonmez x Pervin	2.62	3.04	2.78	+9.35
TT 01339 TT 09214/3 lutessens x Vassa	2.63	3.50	3.03	+15.51
TT 01343 TT 09214/3-1 lutessens x Tanya	2.93	3.33	1.99	+13.65
TT 01344 TT 09214/3-1 lutessens x Nota	2.93	3.50	3.21	+9.03
TT 01345 TT 09214/3-1 lutessens x Trap	2.93	3.26	1.72	+11.26
TT 01353 Z 2009/2-1 (Murov x Aran) x Sonmez	2.30	3.02	2.62	+15.27

The mass of grains per ear was 1.72 g.-3.66 g. in parental forms and ranged from 2.43 g. to 4.36 g. in the second generation (F_2) hybrid combinations. The mass of grains per ear was found to be higher in 27 hybrid combinations, out of the studied 38 combinations, compared with parental forms.

Transgression frequency in the mass of grains per ear ranged from 30.0% to 100.0% in the second

generation (F_2) hybrid combinations of bread wheat. Transgression frequency in the mass of grains per ear in the second generation (F_2) hybrid combinations (total 38) was as follows: in 2 combinations 30%, in 4 combinations 40%, in 5 combinations 50%, in 4 combinations 60%, in 6 combinations 70%, in 3 combinations 80%, in 2 combinations 90%, in 1 combination 100%, in 11 combinations 0%. The combinations TT 01316 Murov x Bezostaya-1 (100%), TT 01317 Murov x Tanya (90%), TT 01353 Z 2009/2-1 (Murov x Aran) x Sonmez (90%) were distinguished by high indices.

The results of the analyses showed that transgression rate was negative in plant height of 50% of the studied in 2014-2015 second generation (F_2) hybrid combinations and positive in ear length, the number of grains per ear, the mass of grains per ear in most of them.

According to the results of our research, combinations distinguished by dominance and heterosis in the first generation (F_1) hybrid combinations led to the formation of positive transgressive traits in the second generation (F_2) hybrid combinations.

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Изучение трансгрессивных изменчивости количественных признаков у гибридов озимой мягкой пшеницы второго поколения

Резюме

Основная цель исследования заключалась в повышении эффективности селекционных работ, проводимых путем выявления комбинаций с высокими трансгрессивными признаками у гибридов раннего поколения, и для идентификации комбинаций в соответствии с целью исследователя. Частота и степень трансгрессии были определены у гибридов второго поколения (F2) мягкой пшеницы в 2014-2015 гг. Как показывают литературные данные, а также результаты наших экспериментов, первое поколение (F1) гибридных комбинаций, отличающихся высоким доминированием и гетерозисом, продемонстрировало положительные трансгрессивные признаки во втором поколении (F2). Следует отметить, что положительные трансгрессивные признаки в гибридных комбинациях показывают, что они превосходят таковые в родительских формах. Исходя из количественных признаков (высота растения, длина колоса, количество зерен на колос, масса зерна на колос), высокая степень трансгрессии наблюдалась у большинства исследованных гибридных образцов, особенно у TT 01304 Муров-2 x Таня, TT 01317 Муров x Таня, TT 01327 Дока x Парвин, TT 01334 Сонмез x Парвин, TT 01339 TT 09214/3 Лютесценс x Васса, TT 01343 TT 09214/3-1 Лютесценс x Таня, TT 01345 TT 09214/3-1 Лютесценс x Трап и т. д.

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