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Selective Evaluation of Winter Bread Wheat Advanced Lines for Adaptability in Garabagh Lowland Conditions

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The study was conducted to determine the adaptive promising lines of winter bread wheat. Adaptability was studied in bread wheat variety samples obtained from intraspecific crossings between 21 parental forms. Long-term observations of promising variety samples of winter bread wheat in the Garabagh Lowland conditions showed that not all varieties had the same behavior under the same growing conditions and differed in the potential productivity. Meanwhile, a few variety samples maintained their productivity over the years. The instability of productivity for many years indicated a lack of high adaptability of most of the variety samples studied. Some promising variety samples were distinguished by a neutral reaction to growing conditions of various years.

Keywords: *Intraspecific crossings, adaptability, perspective lines, variety samples, bread wheat, yield, selection*

INTRODUCTION

Being adapted to a wide range of moisture conditions, wheat is grown on more land area worldwide than any other crop and is an important food grain source for humans. To create qualitatively new varieties of crops in breeding practice, various methods are used to evaluate the initial material, crossing and selection of elite plants, methods for assessing disease resistance, etc., depending on the goals and regions for which the variety is created.

The same genotype grown in different environments often shows significant variation regarding productive performance (Condé et al., 2010; De Vita et al., 2010).

Varieties derived for certain local regions as a rule differ in high yield, but when cultivated in other regions that differ sharply from soil-climatic conditions, they quickly lose their advantages. In many cases, such varieties are inferior even to varieties with an average yield value, but a wide range of plasticity. In addition, it is known that the increase in grain yield as its share increases in the total biological yield leads to a reduction in the quality of the grain-content of protein and gluten (Pinheiro et al., 2013).

Obviously, the issues of increasing the sustainability of wheat production and stabilizing its quality should be addressed in an integrated manner, and above all, by use of varieties well adapted to local conditions. Orientation to varieties with high biological potential of any of the economically valuable traits, to a certain extent, contributes to reducing their resistance to adverse environmental effects (Ivannikov et al., 1998).

In this regard, an important role is assigned to the use of adaptive forms that have a wide range of plasticity to changing environmental conditions that can stably realize their potential. Therefore, along with the creation of new high-yielding and high-quality varieties of crops, the issue of creating varieties with different plasticity, the ability to produce a stable yield under different ecological conditions of cultivation and resistance to biotic and abiotic stresses, always remains an urgent task of breeding (Boyer, 1982). Recently, throughout the world, the trend of rational use of genetic resources, using local and introduced varieties in the breeding process, is aimed at creating, with a genetic basis, resistant to unfavorable environmental conditions varieties. This is primarily due to the global change in climatic conditions, the increase in stressful situations, the increase in temperature, the increase in radiation, salinization of soils, etc., as a result of natural disasters, as well as the emergence of new races of various diseases of crops (Naylor, 1993, Talebi et al., 2009).

In connection with the above-mentioned, based on the achievements of the world practice on wheat breeding, the research is being carried out at the Research Institute of Crop Husbandry to attract introduced and local accessions to create new varieties of wheat with the properties of optimal use of the bioclimatic potential of the growing area.

Azerbaijan among the neighboring countries stands out with an exceptional variety of soil and climatic conditions and relief. Often, there is a sharp variation in weather conditions over the years, which is a limiting factor in yield, as a result of which, a decrease in the yield of wheat in particular years reaches a perceptible limit in some years. The presence of such a wide range of variation in climatic conditions determines the conduct of breeding activities aimed at adaptability and plasticity. It is known that the reaction rates of varieties of agricultural crops in particular wheat, to various ecological situations and changes in climatic conditions determine their adaptive value and plasticity. Even in extremely identical growing conditions, wheat varieties, depending on their biological characteristics and the genetic mechanism that respond to changes in environment, are differentiated in different degrees by yield over the years.

The purpose of the study. The purpose of this research was to determine the adaptive promising lines of winter bread wheat.

MATERIALS AND METHODS

The research was carried out under irrigation conditions at the Terter Regional Experimental Station (RES) of the Research Institute of Crop Husbandry and 21 varieties of bread wheat were used as parental forms. Parental genotypes were taken from the working collection, whose high yield was identified as a result of advance experiments. Intraspecific crosses of these varieties were carried out at the institute. During 2010-2012, 7 constant hybrids - TT 09214/3-1-2 (lutescens), TT 0887/2-1-1-1 (lutescens), TT 09706/2-4 (lutescens), TT 09704/2-4-1 (lutescens), TT 09704/5-2 (erythrospermum), TT 09704/2-4-1-1 (albidum), TT 09224/3-2-1 (lutescens) which are obtained as a result of crossing of landraces and variety samples introduced from international centers were sown on the experimental field of Terter RES in four replicates on plots each with an area of 50 m^2. Before sowing the seeds were treated with Vitavax (fungicide). During the growing season, the crops were treated with the herbicide (Topic 0.80). During the vegetation period, observations were made on the growth and development of plants in various stages of development.

Observations of resistance to diseases were made 3-4 times during the growing season. At the end of the milk ripeness, the plants were removed with roots and measurements were made on the test bundle according to the following characteristics: plant height, number of productive tillers, length of spike, number of spikelet, weight of grain per spike and plant, 1000 kernel weight per four replicates for each variety sample. At complete maturity, the harvesting was carried out and the average yield was determined. The LCD_{05} of experiment was 2.5 - 3.5 cwt/ha (Dospexov, 1985).

RESULTS AND DISCUSSION

Long-term observations of promising variety samples of winter bread wheat in the Garabagh lowland conditions showed that most varieties differ in the ways of the realization of potential productivity. At the same time, the number of varieties that preserved the stability of yields was relatively less by year. The instability of crops over the years indicated a lack of high adaptability of most of the studied varieties. Nevertheless, some promising varieties were distinguished by a neutral reaction to different years of cultivation.

It should be noted that the formation of the yield was largely influenced by the weather conditions at the time of flowering-fertilization and grain filling. This is evidenced by differences in the years, in the same varieties, in the number of seeds per spike, the weight of seeds per spike and1000 kernel weight.

Comparison of the analysis of the spike productivity elements and yield data as a whole showed that the lowest value was obtained in 2010, when the flowering-fertilization stage was accompanied by heavy rains that lasted almost to the beginning of the wax ripeness, which were followed by a sharp increase in the temperature, and led to mechanical maturity of varieties.

The maximum productivity of spike and yield of the studied variety samples was observed in 2012, when the weather favored the development of winter crops, the flowering-fertilization and grain filling stages lasted in mildly hot weather and good solar illumination.

It should be noted that the adaptability of varieties was judged by the difference in the productivity of the spike, by 1000 kernel weight and the yields of the varieties under study by year.

Thus, at the variety sample TT 09214/3 -1-2 lutescens in 2010, the number of grains per spike, the weight of grains per spike, 1000 kernel weight and yield were 42.9; 1.6 g; 30.0 g. and 38.9 cwt/ha respectively. Comparison of these data with the data obtained in 2012 showed that the number of grains per spike is -85.6% of the maximum value of this feature, the weight of grains per spikeis -72.7%, and the 1000 kernel weight is -75.5% respectively. A big difference (42.6%) over the years is observed for the yield of the variety, which is 57.4% of the maximum value. In absolute terms, it is expressed in 18.9 cwt/ha.

Similar results were observed in 75.7% of the varieties, which are classified as non-adapted varieties. Nevertheless, 24.3% of prospective varieties, out of 51, during the study years retained a neutral response to changes in meteorological conditions or less subjected to changes. TT 0887/2-1-1-1 lutescens, TT 09706/2-4 lutescens, TT 09704/2-4-1 lutescens, TT 09704/5-2 erythrospermum, TT 09704/2-4-1 lutescens, TT 09704/2-4-1-1 albidum, TT 09224/3-2-1 lutescens, etc. belonged to such variety samples, including TT 09704/2-4-1 lutescens named "Shafag 2" (in 2010 year) and TT 09706/2-4 lutescens named "Parvin" (in 2012 year) were transferred to the State Service for Registration of Plant Varieties and Seed Control under the Ministry of Agriculture of the Republic of Azerbaijan.

In varieties with a comparatively greater adaptive capacity, the average yield reached up to 70.0 cwt/ha (Fig. 1, 2).

As can be seen in Fig. 1, in the adaptive varieties, the curve of the average yield is approximately in a level position in the interval of yield curves of varieties for individual years. In varieties, of which the yield varies considerably over the years, the curve of the average crop yields as close as possible to the yield curves of the last two years, where the weather conditions were relatively stable and similar (Fig. 2).

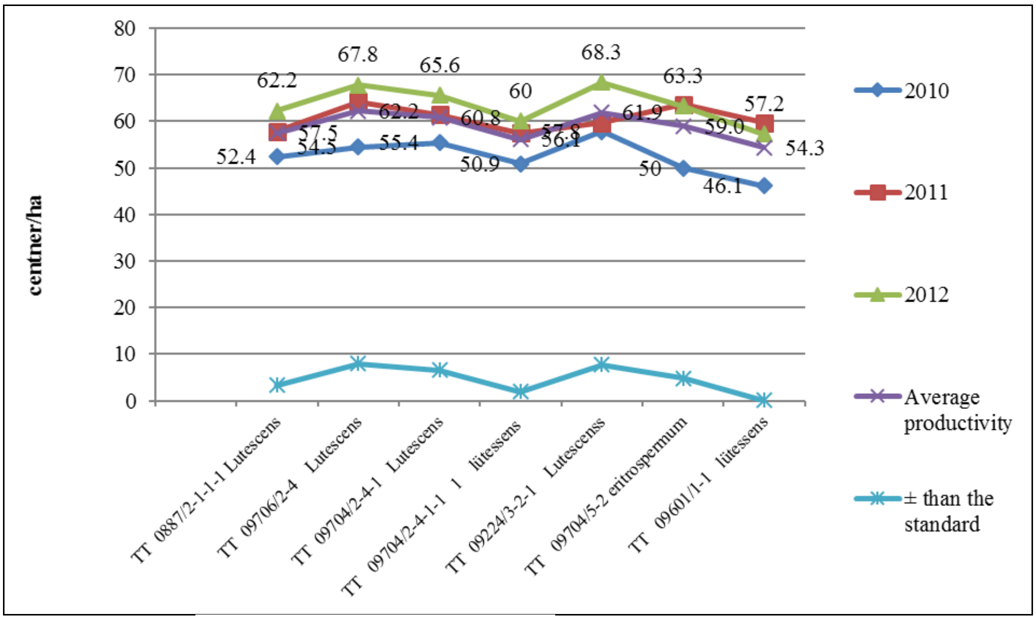

Fig. 1. The yield of comparatively adaptive varieties, cwt/ha.

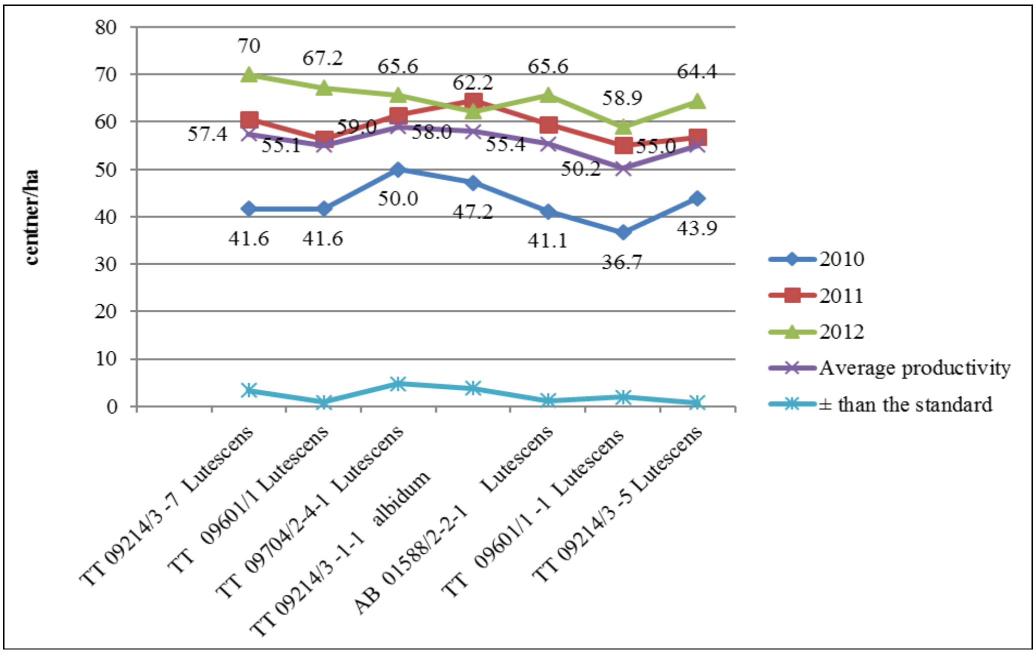

Fig. 2. Productivity of non-adaptive varieties, cwt/ha

It should be noted that to the number of varieties with an adaptive value were both high-yielding varieties, and varieties with an average value of this feature. In some cases, less productive varieties proved to be more stable to changes of the environment than high-yielding ones.

Of no less importance has the definition of the adaptive values of promising varieties for the quality of grain, of which is already impossible to consider the completion of breeding works. It is known that grain quality indicators are genetically determined, but highly dependent on growing conditions, levels of agricultural technology, fertilization and etc. (Dias and Lidon, 2010).

According to the results, the gluten content of adaptive varieties excluding TT 09704/2-4-1 lutescens and TT 09704/5-2 erythrospermum slightly changed by year and the average value of gluten indicators was between the mean value of this characteristic by years (Fig. 3).

Similar results were obtained with respect to the gluten quality index (GQI) of adaptive varieties, which indicates independence from environmental conditions over the years of cultivation (Fig. 4).

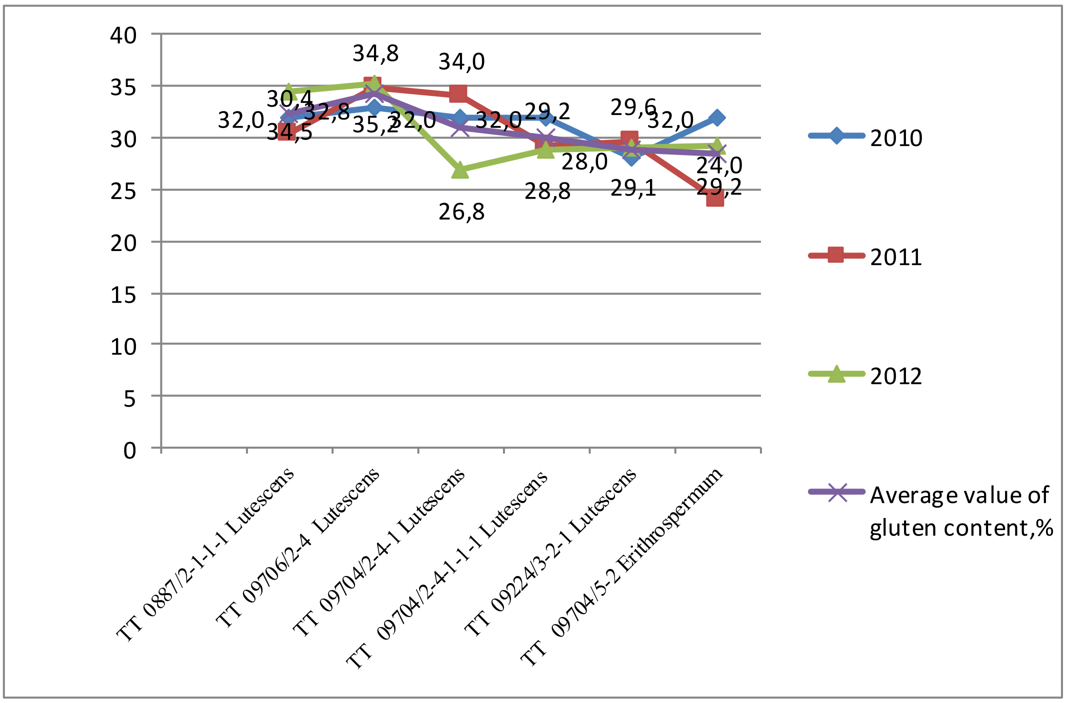

Fig. 3. Gluten content of adaptive varieties, %.

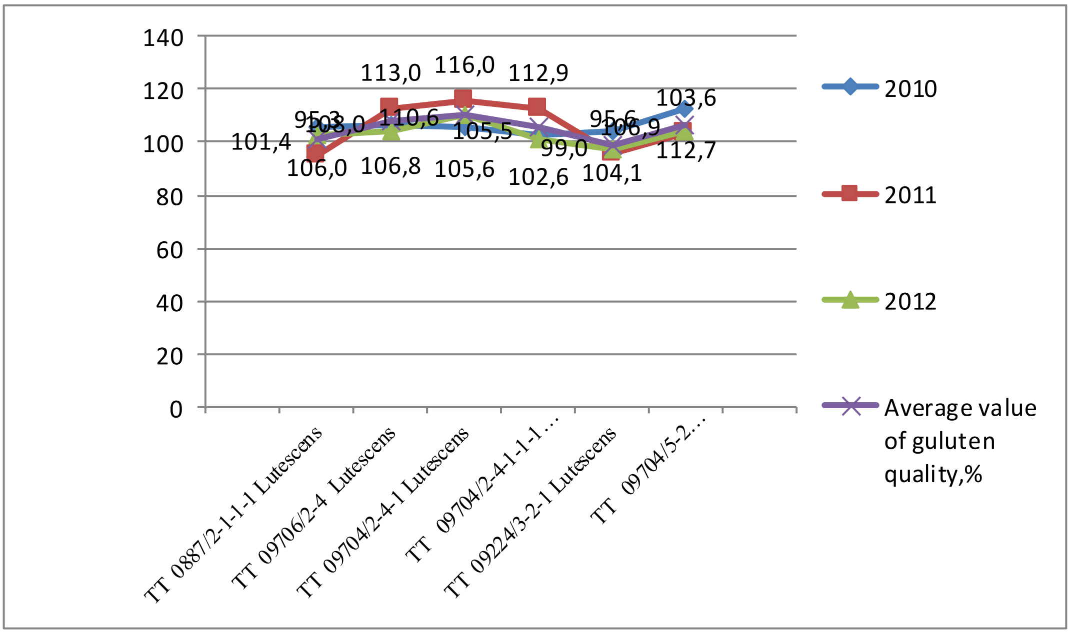

Fig. 4. Indicators of GQI of adaptive varieties

As can be seen in Fig. 5, the improvement in growing conditions over the years has positively affected the sedimentation indices of only one line, TT 0887/2-1-1-1 lutescens. So, in 2010, sedimentation rates for this line was 22.5 ml., and, in 2011-2012 this indicator increased to 34.5 ml. The exception was also the line TT 09706/2-4 lutescens, when the value of the sedimentation (35.2 ml.) only in 2012 was very different from the previous ones (22.5 ml).

Thus, the study of both groups (adaptive and non-adaptive) varieties and lines did not reveal a significant difference in the years between groups in terms of the quality of grain, as can be seen in the gluten content (Fig.6). The only significant deviation in the gluten content by year that was observed in 2012 at the TT 09214/3-1-1 albidum line seems to be due to either a successful combination of the passage of the development stage during the growing season with the weather condition prevailing in the given year or own responsiveness of the genotype to change the weather conditions, or is the result of an accidental technical error that requires additional verification.

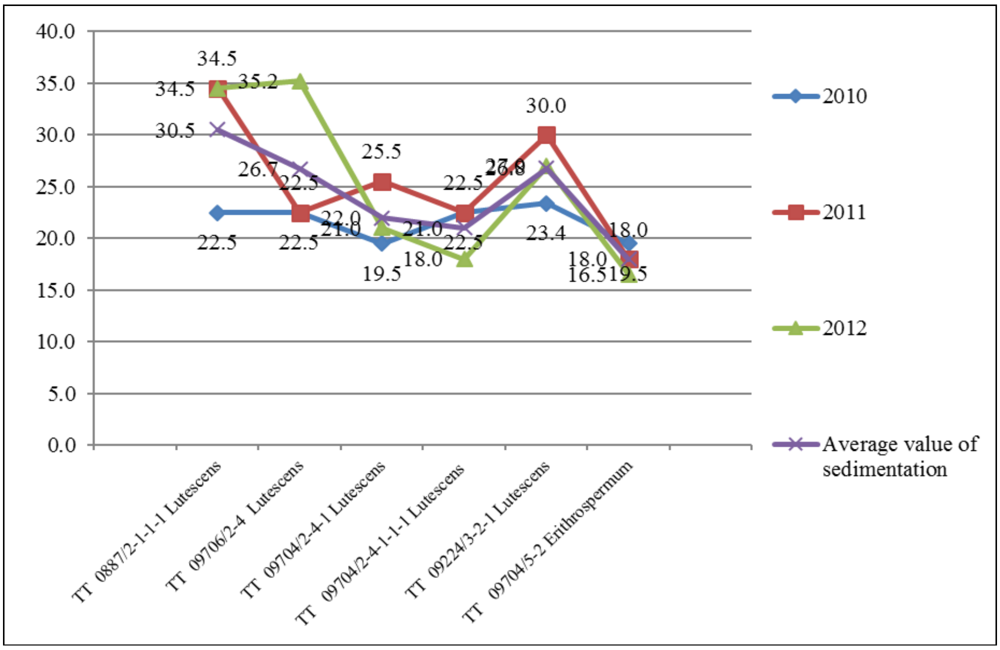

Fig. 5. Sedimentation indicators of adaptive varieties, ml.

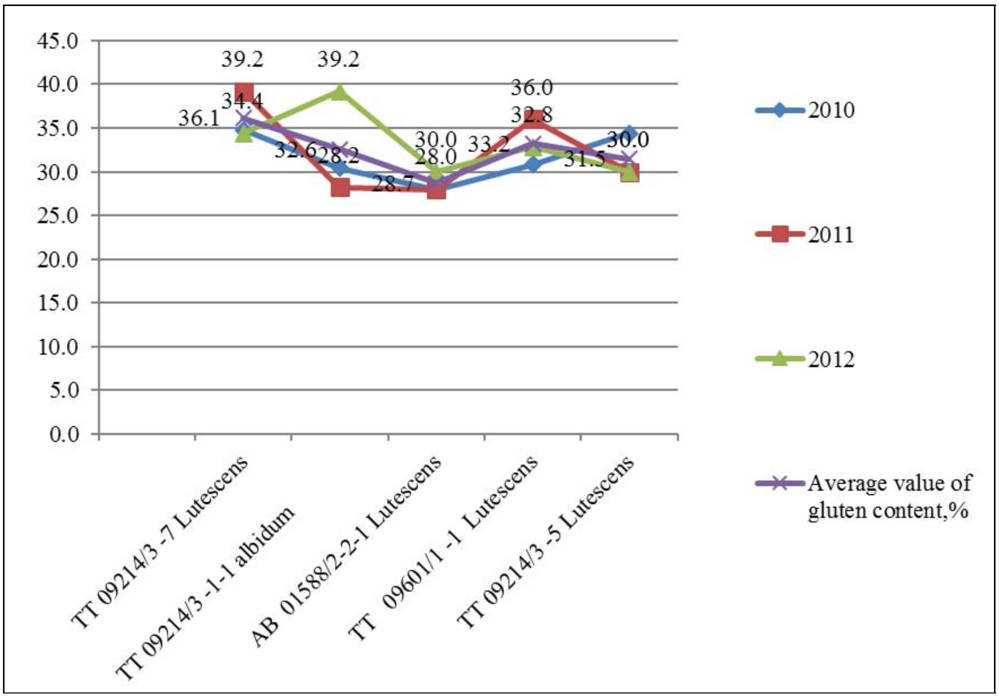

Fig. 6. Gluten content of non-adaptive varieties, %.

The study revealed that a differentiated approach to the selection of varieties for cultivation, especially in regions with an unstable climate over the years is very important. This approach helps eliminate the risk associated with the negative impact of weather conditions.

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Payızlıq Yumşaq Buğdanın Perspektiv Xətlərinin Adaptivliyinin Düzən Qarabağ Şəraitində Qiymətləndirilməsi

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Tədqiqat payızlıq buğdanın adaptiv perspektiv xətlərinin müəyyənləşdirilməsi məqsədi ilə aparılmışdır. 21 valideyn forması arasında növdaxili çarpazlaşdırılmadan əldə edilən yumşaq buğda sortnümunələrində adaptivlik tədqiq edilmişdir. Düzən Qarabağ şəraitində yumşaq buğdanın müxtəlif persüpektiv sortnümunələrində çoxillik müşahidələr göstərir ki, heç də sortnümunələrin hamısı becərildiyi eyni şəraitdə eyni dərəcədə özlərinin məhsuldarlıq potensialını realizə edə bilmir. Bununla belə, illər üzrə az sayda sortnümunələrözünün məhsuldarlığını qoruyub saxlaya bilmişlər.İllər üzrə məhsuldarlığın qeyri-sabitliyi tədqiq edilmiş sortların əksəriyyətinin kifayət qədər yüksək adaptivliyinin olmadığını göstərir. Bəzi perspektivsortnümunələr müxtəlif illərin becərmə şəraitinə neytral reaksiyaları ilə fərqlənmişlər.

Açar sözlər: *Növdaxili çarpazlaşdırılma, adaptasiya, perspektiv xəttlər, sortnümunələr, yumşaq buğda, məhsuldarlıq, seçmə*

Оценка Адаптивности Перспективных Линий Озимой Мягкой Пшеницы в Условиях Равнинного Карабаха

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Работа проведена с целью выявления степени адаптивности перспективных линий озимой пшеницы. Изучена адаптивность сортообразцов мягкой пшеницы, полученных от внутривидового скрещивания родительский форм. Многолетние наблюдения показали, что не все перспективные сортообразцы мягкой пшеницы могут в равной степени реализовать свою потенциальную урожайность в условиях равнинного Карабаха. Вместе с тем, небольшое число сортообразцов сохранило свою урожайность. Исследования по выявлению причин нестабильности урожая в зависимости от года выращивания указывают на отсутствие достаточной адаптивности у большинства сортов. Некоторые перспективные сортообразцы отличались нейтральной реакцией на изменяющиеся по годам условия культивирования.

***Ключевые слова**: Внутривидовое скрещивание, адаптация, перспективные линии, сортообразцы, мягкая пшеница, урожайность, отбор*