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Ecological plasticity and stability of collection samples of naked oats in the conditions of the Northern TRANS-Urals

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The estimation of collection samples of naked oats by productivity and parameters of ecological plasticity in the conditions of the Northern TRANS Urals for 2012-2015 is given. The objects of the study were 34 samples of naked oats of different ecological and geographical origin, obtained from VNIIR im. N. I. Vavilova. The Eberhart and Russell method was used to characterize the ecological plasticity of the varieties of naked oats. It is based on the calculation of two parameters: the linear regression coefficient (bi) and the variance (σ2d). The first shows the response of the genotype to the improvement of growing conditions, and the second characterizes the stability of the variety in various environmental conditions. Assessment of the ecological plasticity of the varieties of naked oats by the linear regression coefficient (bi) showed that all varieties respond well to changes in growing conditions. We selected breeding material with high responsiveness to environmental conditions and a consistently high yield. These varieties should be used as sources in the selection process to obtain new genotypes with high adaptive properties.

Keywords: Genotype, environmental plasticity, stability, naked oats, linear regression.

INTRODUCTION

Facing the adverse effects of climate change is one of the biggest challenges. Extreme weather conditions have changed the overall distribution of yearly rainfall, shifted cropping seasons, increased infestation of crops by pests and diseases. At the same time, demand for food is rapidly increasing with the population. Enhancing resilience is a major challenge not only for agricultural sustainability but also for the substantial non-farm rural economy (Md. Shahidul Haque Bir et al., 2018, Sameh et al., 2019).

Environmental conditions have a significant impact on the development of economic characteristics that determine their productivity (Kumar 2017). In adverse conditions, great importance is given to the productivity of varieties and their environmental sustainability

Western Siberia is the largest region of grain production in the Russian according to (Sapega 2019), but the continental climate and the complex nature of environmental conditions lead to strong variability in the yield of grain crops. In this regard, the problem of growth crop yield in this region should be combined with elements of its stabilization. Currently, only 50-60% of the genetic potential of varieties approved for use is realized in mass production. The main reason for this is the insufficient level of adaptability of the zoned assortment so special attention is paid to the relation to environmental factors which act as a decisive factor in the realization of the potential productivity of oats. In recent years, interest in studies of the ecological plasticity of crop varieties has grown particularly. This is due to the unstable weather conditions in the country and the

widespread introduction of cultivation technologies into production (Batalova ,2016). This is due to the unstable weather conditions in the country and the widespread introduction of cultivation technologies into production (Tufte 2017). It is based on homeostatic reactions. These reactions are caused by a number of signs, the most important of which include the growing season, the rhythm of development, the speed of filling of grain during ripening, the attitude to heat and cold, the attitude to soil and atmospheric drought, the attitude to edaphic differences, the germination of the roots and the duration of post-harvest ripening, resistance to diseases and damage by insects, etc.

Yield and its stability are determined by environmental conditions, many of which are not regulated (temperature, rainfall, daylight hours, etc.).

Variability of environmental conditions leads to high variability of productivity and its quality. The selection of varieties with high adaptability contributes to a lower yield reduction (Weber 2018).

Adaptation is the process of adaptation of the cenosis to changing environmental conditions and cultivation technology, the processes are implemented through the most important functions of the body, primarily through plant growth related to productivity and yield (Chen 2017).

Plasticity of plants is defined as a variation of phenotypic expression of a genotype that occurs in response to certain environmental conditions and increases the individual's ability to survive and reproduce under these conditions (Sadimantara et al., 2018,). Environmental factors affect the plasticity and stability of plants (Gao et al., 2019).

MATERIALS AND METHODS

The objects of research were 34 varieties of naked oats of different ecological and geographical origin, obtained from VNIIR im. N. I. Vavilova. As standard was used the Tyumen hulless variety grown in the region. Environmental plasticity and stability were evaluated by EA Eberhart and V.A. Russell in the methodological version of V.Z. Pakudina and L.M. Lopatina, where the plasticity of varieties is estimated by the regression coefficient (bi), which characterizes the average response of the variety to changing environmental conditions, and stability - by the variance sign (Si 2) (Zykin 2011).

RESULTS AND DISCUSSION

Studies conducted have shown that environmental condition indices (Ij) vary greatly across the years of the study. The most favorable conditions for the growth and development of plants were in 2013, these conditions allowed to form the highest yield. Thus, with the index of environmental conditions (Ij = +153), the average yield per experiment was 389 g / 2. m. Adverse conditions for growth and development were observed in 2012 (Ij = - 108), 2014 (Ij = -14) and 2015 (Ij = - 30), which affected the average yield of 127 g/m2, 222 g/m2, 205 g/m2, respectively. The most responsive varieties to the environmental conditions were the varieties k-2471 (Mestny, Mongolia); K-8580 (line 119 1/28, Ukraine); K-11003 (Vicar, Canada); K-11447 (Saia 2, Israel); K-15088 (MF9224-101, USA); K-15089 (MF9224-106, USA), etc. with an increase in yield by 1 g / m2, they increased their 1.11-1.93 g / m2. Varieties Grades k-1926 (Hull-less, China); k-15116 (Murom, Kemerovo region); K-15160 (MF9521-79, USA); k-15278 (Persheron, Kirov region) with a regression coefficient (bi <1) are the least responsive to improving growing conditions, they increase their yield by 0.18-0.48 g / m2. The collection samples k-15339 (Progress, Omsk region.), K-11447 (Saia 2, Israel), k-2301 (Hullessoats, Canada), k-14364 (Belorussian glazerny, Belarus) are the best in this set of samples (bi respectively 1.44; 1.93; 0.94 and 0.77). They are characterized by high responsiveness to improved growing conditions, as indicated by the regression line. In adverse conditions, the yield of these varieties is higher than the average experience yield.

Progress, Omsk Region, (k-1533) (bi = 1.44) is characterized by high responsiveness to improved growing conditions, the regression line of this variety is higher than the others under favorable conditions. In adverse conditions, yield also remains above average experience. The regression line of the collection sample k-2301 (Hullessoats, Canada) (bi = 0.94) runs parallel to the average experience, the yield of this variety changes as well as the average yield, with changing environmental conditions (Figure 1). Significant differences in stability were found between varieties k-15099 (MF9809-19, USA) and k-14226 (Run 1, Belarus) - σ2d (1) / σ2d (2) = 21613/716 = 30.18, 30.18.119.0. This indicates the high stability of k-14226 (Beg1, Belarus) and its significant superiority over to -15099 (MF9809-19, USA). There were also significant differences between the varieties k-15060 (MF9521-79, USA)

and k-15067 (Golets, Krasnoyarsk Territory) - σ2d (1) / σ^2 d (2) = 31399/697 = 45.05 45.05>19.0.

This indicates the high stability of k-15067 (Golets, Krasnoyarsk Territory) and its significant superiority over k -15060 (MF9521-79, USA).

CONCLUSION

Assessment of the ecological plasticity of the varieties of naked oats by the linear regression coefficient (bi) showed that all varieties respond well to changes in growing conditions.

The varieties of naked oats: K-14226 (Beg 1, Belarus), k15067 (Golets, Krasnoyarsk territory). Were characterized by high stability in yield.

Thus, promising yield lines of naked oats were identified, combining high plasticity and stability.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

YI developed, performed the experiment, and wrote the manuscript, MF analyzed the manuscript, and AY analyzed the data. All authors read and approved the final version.

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