Title of the project: IRN AP14870923 «Development of techniques for increasing productivity, drought tolerance of wheat in arid conditions of Central, Northern Kazakhstan using mathematical modeling»

Relevance: Currently, applied dynamic models of the production process of agricultural plants are an important instruments for the introduction of modern high-tech technologies into the traditional practice of crop production.

The development of adaptive techniques to increase the drought resistance of spring soft wheat in arid conditions of Northern Kazakhstan using mathematical modeling allows to significantly simplify the analysis of a variety of alternative solutions and the choice of optimal agricultural technologies compared with the traditional approach.

In this regard, the application of a complex of agrotechnical measures to increase the drought resistance of spring soft wheat in arid conditions of Northern Kazakhstan using mathematical modeling is an urgent problem and has great theoretical and practical significance.

Goal of the project: Application of mathematical modeling in the development of a set of agronomic measures to improve productivity and drought resistance of spring wheat in severe continental arid soil-climatic conditions of central and North Kazakhstan

Expected and achieved results: The influence of studied factors on drought resistance of spring wheat varieties based on molecular genetic evaluation will be established and recommendations for their use will be given.

The optimal technological parameters of pre-sowing treatment of spring wheat seeds with micronutrients contributing to increased drought tolerance and productivity will be established, taking into account the soil and climatic conditions of Northern and Central Kazakhstan.

With the help of mathematical modeling the optimal elements of agrotechnological methods of surface tillage on the productivity of spring soft wheat in the arid conditions of Northern Kazakhstan will be established.

Based on mathematical modeling for different soil and climatic zones of Northern and Central Kazakhstan will be created a model of drought-resistant variety of spring wheat.

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Research results:

To conduct research, field testing grounds were laid in two farms in Northern and Central Kazakhstan:

1. LLP "Scientific and Production center of grain farming named after A.I.Barayev" (field No. 10, on an area of 40 hectares) - dry steppe zone, southern chernozem, small-scale plain, Akmola region;

2. "Naydorovskoye" LLP (field No. 11, on an area of 40 hectares) - dry steppe zone, chestnut soil on a small mound, Karaganda region.

The technology of soil preparation corresponded to the generally accepted one for the respective zones.

The selection of drought-resistant varieties of spring soft wheat was carried out by the SNP Amplifluor method and as a result of genotyping 11 varieties of spring soft wheat according to 3 genes TaLTP, TaPARG, TaPPH, Taimas and Granii varieties were isolated. These varieties of domestic (Taimas- originator of the Scientific Research Center named after A.I. Baraev, Republic of Kazakhstan) and foreign breeding (Granni – originator SAATBAU LINZ eGen Austria) are recommended for selection as donors - carriers of single nucleotide polymorphism, which is associated with a sign of drought resistance.

When using a solution of a complex of microelements in conditions of drought stress, the germination of spring wheat seeds increased to 13.12% compared with the option without the use of microelements.

Under conditions of drought stress, many germination parameters were positively and significantly correlated, especially in germination ($r=0.8$-0.86), in shoot area ($r=0.7$-0.74) and in germination viability index ($r=0.74$-0.9).

The results of field experiments in both research points showed the effectiveness of the use of seed treatment with microelements and after sowing, the increase in yield reached up to 6.68 c/ha. The maximum yield of the Taimas variety in the conditions of Central Kazakhstan was -27.98, in the Granii variety - 31.44 c/ha.

The results of the simulations showed that the Grania varieties as the best model have a sufficient range of confidence (Rx – 0.91) to obtain reliable forecasts and accurately simulate high drought resistance than other varieties. The value of the simulation model of drought resistance of the Granii variety obtained by us was more than 37.7% higher than the Taimas variety.

The analysis of the mathematical model showed that the optimal parameters of drought–resistant varieties of spring soft wheat are the presence of positive homozygous genotypes 'bb', seed treatment before sowing with complex

micronutrients (Zn - 1.0, Co- 0.5g, Si- 0.5g, Cd-0.4%), carrying out leaf fertilization during tillering (chelated forms of micronutrients - Zn – 1.5, Co- 1.0, Si- 0.5 and Cd-0.5%) and carrying out soil rolling after sowing and harrowing the soil during the tillering of spring soft wheat.