Molecular-genetic methods for assessing the drought resistance of spring barley

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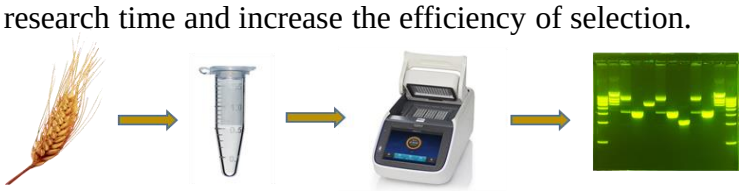
Introduction. In the conditions of sharply continental climate of the Southern Urals, the lack of moisture during the growing season is a limiting factor in realization of the potential yield of agricultural crops. In the breeding process, the assessment of the drought resistance of the variety is based on long-term observations in the field. The introduction of molecular genetic methods for assessing plant material will eliminate dependence on weather conditions, shorten the research time and increase the efficiency of selection.



Materials and methods. As an object of research, we took varieties and lines of spring barley from the control nursery of the Department of Breeding and Seed Production of Grain Crops of the Federal State Budgetary Research Institution FSC BST RAS. For research, a working sample was formed, it included 150 samples with high potential productivity. The spring barley variety Natali was used as a control. Barley samples were evaluated for drought resistance directly in the field by direct signs. Under normal field conditions, all the studied varieties and breeding numbers were carefully monitored for drought resistance, yield and product quality of the varieties in dry and favorable periods for moisture.

Results. The prevailing conditions of weather factors served as a good background for assessing the material for its resistance to air and soil droughts (the amount of precipitation was more than 2 times lower than the average long-term values). Phenotypic assessment and assessment of productivity indicators of the stem showed that the numbers have a wide norm of reaction to stress caused by a lack of moisture.

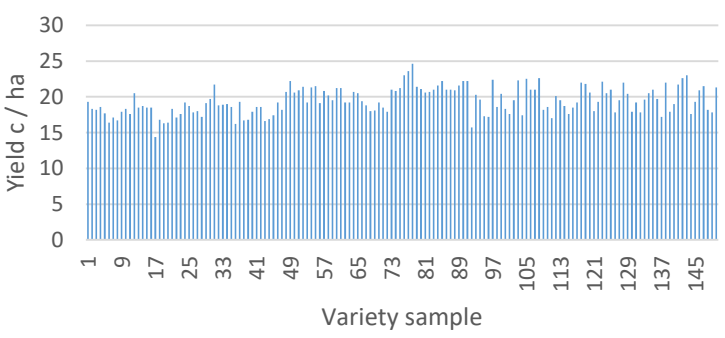
Characteristics of weather conditions during the growing season of barley in 2020

Month	The amount of precipitation, mm		Air temperature, C°				Productive moisture in the soil before sowing, mm
	in fact	Medium-long-term	max.	minimum	average	Average long-term	
May	5,7	12,0	30,0	1,6	16,2	11,6	
	31,4	12,0	24,0	1,0	13,4	14,0	172
	6,1	13,0	33,7	2,5	20,3	16,3	
Per month	43,2	37,0	33,7	1,0	16,6	13,9	
June	3,7	14,0	30,2	9,8	21,2	17,8	
	0,0	15,0	33,7	5,9	20,2	18,8	
	14,6	15,0	31,2	4,0	15,3	19,7	
Per month	18,3	44,0	33,7	4,0	18,9	18,8	
July	0,0	16,0	37,7	6,6	23,9	20,4	
	9,7	15,0	40,0	15,6	28,3	21,0	
	14,7	15,0	35,8	9,4	21,5	21,0	
Per month	24,4	46,0	40,0	6,6	24,6	20,8	
August	9,6	11,0	36,5	11,7	23,6	20,3	
	26,1	10,0	27,6	5,2	16,4	19,2	
	0,0	10,0	34,8	5,0	20,1	17,7	
Per month	35,7	31,0	36,5	5,0	20,0	19,1	

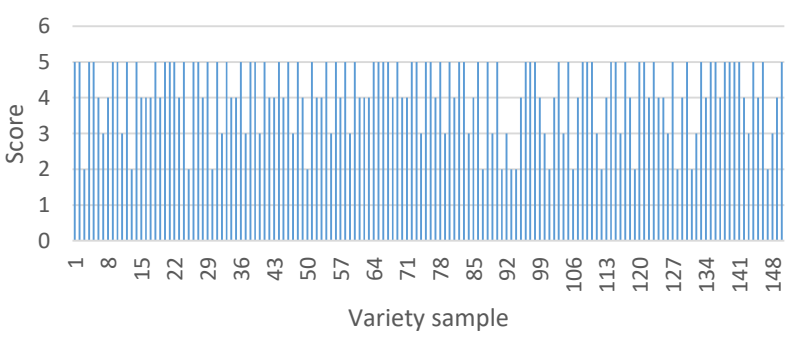
The table shows that the weather conditions in the growing season of the reporting year were as always ambiguous. The amount of summer precipitation in 2020 was more than 2 times less than the average long-term values. Weak precipitation in June and July, plus the most severe temperature pressure, increasing from June to the end of the 2nd decade of July, when the air temperature reached +40°, and its average values up to 28°, which is higher than the average annual norm by 7° Celsius, formed the strongest late-summer drought. The peak of this drought coincided with the flowering, formation and filling of grain, which contributed to the appearance of overgrain, frailty and a sharp decrease in grain productivity. The average yield of the standard Natalie variety in the main nurseries of the first sowing period on May 10 was 16.4 c/ha.

This level of yield was achieved due to the relatively early sowing period for steam with a good supply of pre-sowing moisture. While late sowings further reduced the grain yield. For example, sowing numbers in the nursery of hybridization after two weeks led to a decrease in grain productivity by 2-3 times, where the grain yield in the context of varieties ranged from 4.0 to 8 c/ha. Thus, the current conditions of weather factors in 2020 served as a good background for assessing the selection material for resistance to air and soil droughts. The second stage of the research includes the formulation of a methodology and assessment of drought tolerance of cultivars by the method of quantitative assessment of cDNA genes associated with the response of plants to water stress. Total RNA is planned to be isolated from etiolated seedlings using ready-made kits according to the manufacturer's instructions.

Yield indicators of the best varieties of barley 2019-2020



Phenotypic assessment of drought resistance of the best barley cultivars 2019-2020



Conclusion. Thus, it was found that the studied barley varieties reacted to the stress factor to different degrees. In conclusion, the assessment of the genetic potential of the working sample, the degree of phenotypic manifestation of the studied genes will be carried out, and donors of economically valuable traits will be selected.