EXAMINING PERSPECTIVE SOWING OAT VARETIES BY YIELD STRUCTURE ELEMENTS IN CENTRAL YAKUTIA

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Abstract: The article presents the results of a study on competitive variety test sowing in sowing oat crops under the conditions of Central Yakutia that was carried out in the 2011-2013 period. The aim of this study was to distinguish the most significant sowing oat varieties among numerous selection strains under Central Yakutia's conditions. Sowing oats (*Avena sativa* L.) is one of the leading grain crops cultured in Central Yakutia permafrost zone for feeding purposes. Field studies on competitive varieties assessment were carried out on permafrost forest soils from the Khangalassky district of Central Yakutia in 2011-2013. Several assessed varieties: K - 1608, K - 4880, K - 4022, K - 4902, K – 3476, were shown to produce the highest yield of 3.1 t / ha and hence obtain the greatest interest. Variety specimens K - 4902 (47.9), K - 1608 (47.7) were characterized by the notably greater grain number. The highest yield of grain was observed at number K - 3476 - 32.6% and K - 1608 - 33.0%. In the future, the mentioned sowing oat varieties will be used for oat selections under central Yakutia conditions.

Key words: *Avena sativa* L., varieties, grain yield, competitive variety trial, 1000 grain mass, grain yield.

Introduction

In recent years, the demand for oats and its attractiveness in the market have been increasing, due to this crop universality. Globally, the oat sown areas occupy the 5th place by its size, after wheat, rice, corn, and barley.

Oats are the leading grain crop cultivated for feeding purposes in the permafrost zone poor setting of grain crops cultivated for fodder purposes. It is cultivated in its pure form, mixed with various legumes, oilseeds, both for hay, silage and haylage. The main requirements for the newly created varieties of grain crops are high stable productivity, adaptability to local cultivation conditions [5]. Breeders of the republic are faced with the task of introducing and introducing into production early and medium early varieties of oats, which have drought tolerance and high adaptability to extreme zonal climate characteristics. The following characteristics have been reported to assist in the improvement in the grain productivity — 1000 grain mass, panicle grafting, grain mass per panicle, and lastly grain yield. At the same time, even if one characteristic is inferior, it can to some extent be compensated by a more intensive improvement of others [1, 3].

Currently, the interest in the identification of promising varieties of seed oats that are most adapted to the conditions of Central Yakutia has been rising, following to its productivity characteristic elements as well as the main economically valuable traits, compared with the standards for further selection. The long-term analysis of varieties that were cultivated during years with different weather and climatic conditions allows us to evaluate the adaptability and stability parameters of the crop.

Materials and methods

This research project was conducted from 2011 to 2013 at the experimental sites of the Grain crops Pokrovsky station under the Yakutsk Research Institute of Agriculture. The material for the study was 8 perspective cultures of competitive strain testing. The experimental plot soil was permafrost-taiga, fawn, medium loam type. The humus content in the arable layer was 2.67%, with a depth its content decreases to 0.44%. The content of mobile phosphorus was 104.3 mg per kg of soil, exchange potassium 274 mg/kg, and total nitrogen varied from 0.12% to 0.24%.

The assessments plot for the competitive variety testing chambers was 25m2 each, with a total of four repetitions using the randomized placement method. Observations and counts were carried out in accordance with generally accepted methods [2]. The data from experiments were processed via variance analysis method according to Armor with the help of the application package "SNEDECOR" [6, 7].

Results and discussion

Central Yakutia is characterized by a sharply continental climate with wide air temperature annual fluctuations and little precipitation. Absolute annual temperature fluctuations are 100-1250C. Summers are short (June-August), hot and with an uneven rainfall distribution. In the hottest month (July), the absolute maximum of air temperature reaches 37 ° C.

During the study period, meteorological conditions were characterized as moderately humid in 2011 (Hydrothermic coefficient, HTK = 1.01), insufficiently humid in 2012 (HTK = 0.32) and sufficiently humid in 2013 (HTK= 1.34). Due to abundant rainfall throughout the growing season in 2011 and 2013, the HTK was sufficient for the growth and development of oat crops. Spring in 2011 was relatively early and dry, moisture closure in grain crops areas began from the May second decade. The weather in May was stable, the maximum air temperature during the third decade reached + 26.0 C. The minimum air temperature in the 2nd decade dropped to - 8 ° C. Precipitation rate was two times lower from the normal rate in the second decade - 2 mm. The total precipitation for the month reached 25 mm. The average monthly air temperature in May

was 8–9 ° C, the warmest months were 2011-2012 June-July, and in 2013 June-July was cool, only 2013 August was slightly warmer.

In general, the summer of 2011 and 2012 was high in temperature, with dry winds and uneven precipitation distribution. In May 2013 precipitation rate was 2.7 times higher than the norm (56.5 mm against the norm of 21 mm). The summer months were high in precipitation and slightly lower in temperature. The average monthly air temperature was 14.8-17.4 ° C. Precipitation in June's first decade was 7 times higher, in June - 2.5 times, in July 2.3 times higher than normal. August was considered to be cool with 2.2 times lower precipitation rate compared with average (18.1 mm with an average annual norm of 41 mm).

During the experimental period, the average growing seasons were lasting for 63 and 70 days respectively. 3 varieties K - 2154, K - 4902, K - 2829 were detected to possess the highest precocity after 3 years of study. The highest grain unit was shown to owned by variety number K-1608– 552.0 g/l and K-4902 is 536.0 g/l. Varieties with the lowest grain unit were K-2829 - 516.0 g/l., K-2154 - 521.0 g/l. The largest grain yield was observed for K-3476 number - 32.6.0% and K-1608 - 33.0% (Table 1).

Table 1

Commercially valuable characteristics of perspective oat numbers in the competitive strain testing 2011-2013

Variety, number	Vegetative period, days	Lodging degree, score	Grain yield,%	Grain unit, g/l	Hoodness, %
Standard "Pokrovsky"	70	6	26,6	536	23,0
2829	63	7	31,4	516	22,4
2154	65	7	31,2	521	22,4
4880	66	9	30,1	525	22,2
3476	68	7	32,6	533	22,5
4022	67	7	31,9	529	22,8
4902	65	9	32,4	536	23,4

Crops height is an important parameter due to its tight association with the resistance to lodging, which is known to influence the yield. The height of plants in perspective cultivated oats varieties ranged from 84.3 to 94.2 cm. Variety numbers K-4880 and 4902 stood out with the lodging resistance - 9 points. The remaining variety sample were shown to be less resistant to lodging - 6-7 points. The panicle length for number K-2829 ranged from 14.4 cm, and for numbers K-4880, K-1608 to 15.6 cm. For the standard variety Pokrovsky, panicle length was 16.1 cm. Single panicles formed from 41.1 to 47.9 single grains. The largest number of them was recorded at number K-4902 (47.9) and K-1608 (47.7). The grain mass per panicle varied from 1.1 g (K-2154) to 1.4 (K-4880, K-3476, K-4022, K-1608). The standard variety Pokrovsky grain mass per panicle was 1.1 g. Most of cultivated oat varieties produced large grain- the weight of 1000 grains was comparatively variable with, for example, number K-2154 giving 31.2 g and K-3476 giving 36.2 g. For the standard variety Pokrovsky, weight of 1000 grains it was 33.6 g.

In insufficient 2012, the grain yield reached 1.3 t/ha for the standard variety Pokrovsky, and for the remaining varieties varied from 1.2 to 1.7 t/ha. The average yield for 2011-2013 ranged from 2.4 to 3.1 t/ha, the standard variety Pokrovsky was 2.6 t/ha. The tested oat numbers K-4880,

K- 3476, K-4022, K-4902, K-1608 were shown to significantly exceed the standard by grain yield (Table 2).

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Table 2

Characteristic elements of perspective oat variety yield structure from the competitive strain testing 2011-2013

Variety, number		Height, cm	Panicle length, cm	Grain mass per panicle, kg	Grain number per panicle	1000 grain mass, g	Productive tilling	Yield, t/ha	% к st
st Pokrovskiy		94,2	16,1	1,1	41,9	33,5	2,2	2,6	100
2829		84,3	14,4	1,2	41,1	31,4	2,6	2,6	100
2154		89,0	14,9	1,1	40,6	31,2	2,8	2,4	92,3
4880		89,7	15,6	1,4	46,5	33,6	2,5	3,1	119,2
3476		85,4	15,5	1,4	42,8	36,2	2,6	3,1	119,2
4022		88,2	15,5	1,4	45,7	31,9	2,5	3,1	119,2
4902		90,4	15,4	1,3	47,9	32,4	2,5	3,1	119,2
1608		91,6	15,6	1,4	47,7	33,0	2,2	3,1	119,2
$НСР_{05}$	2011							0,64	
	2012							0,58	
	2013							0,77	

*st- is for “standard”

Panicle productivity has a significant effect on yield. With an increase in panicle productivity by 10%, the yield of oats increased by 7–9% [1]. Previously researchers have made similar conclusions [1], arguing that an increase in grain mass from a panicle by 1 g gives a yield increase by an average of 113.3 g/m [4].

In our study, this observation was shown to be relevant. We also were able to include additional pieces of evidence. We confirm that increasing grain yield correlates with an increase

in the grain mass per panicle. To clarify, if the standard variety Pokrovsky had 1.1 grams of grain per panicle, providing a grain yield of 2.6 t / ha, then 4 competitive variety numbers showed an increase in yield to 3.1 t / ha. Their grain mass per panicles varied from 1.3 ... 1.4 g. However, the variety number K-2154 revealed lower grain yield against the standard by 0.1 tons, even considering an equal grain weight per panicle of 1.1 g, as in the standard variety Pokrovsky. This phenomenon can be explained by the fact that the shortened growing period in the variety number K - 2154 by 5 days induced the overall decrease in the 1000 seeds masses to 32.9 g, compared with the standard of 33.5 g.

Conclusions

Thus, based on research conducted on competitive strain testing, we have identified the most promising variety samples that are able to form crops with high indices of yield structural characteristics. According to the results of a competitive study of oats in Central Yakutia, numbers were identified that have the highest yield of 3.1 t/ha. Variety numbers K-1608, K-4022, K-4902, K-3476 formed the highest yield and grain nature to the level of 31.9 - 46.0% and 533 - 552 g/l. By their precocity, 3 variety numbers: K-2154, K-4902, K-2829 were selected. In the future, these numbers will be used in breeding spring oats in the conditions of Central Yakutia.

Spisok literatury

1. Batalova G.A. Tekhnologiya vyrashchivaniya ovsa i selekciya. Kirov: NIISH Severo-Vostok, 2003. - 206 s.
2. Metody gosudarstvennogo sortoispytaniya sel'skohozyajstvennyh kul'tur / M .: Kolos, 1971. 239 s.
3. Petrova L.V. Razvedenie ovsa v usloviyah YAkutii: monografiya / FGBU «YAkutskij nauchno-issledovatel'skij institut sel'skogo hozyajstva im. M.G. Safronov ». - Novosibirsk, 2018. - 135 s.
4. SHafranskij V.P. Effektivnost' uha (metelki) i urozhaj // Nauchno-tekhnicheskij. byk. Nauchno-issledovatel'skij institut rastenievodstva. Severnaya Irlandiya Vavilova. -1980. - vypusk 138. - S. 26-28.
5. SHCHennikova I.I., Kokina L.P., Butakova O.I. Ocenka genofonda yachmenya po razmeru zerna v Volgo-Vyatskom regione. // Agrarnaya nauka evro-severo-vostoka. 2011. №1 (20). S. 12-16.
6. Dospekhov B.A. Metodologiya polevogo opyta. M .: Kolos, 1978. 347 s.
7. Sorokin O.D. Prikladnaya statistika na komp'yutere. Novosibirsk, 2004. - 162 s.