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Response to environmental cultivation conditions of spring wheat varieties of different maturity groups

Wheat is the main grain crop grown in global agriculture, including in Russia. The main goal of farmers is to produce wheat grain in a volume sufficient to meet food and feed purposes, with high quality indicators. Possessing such a property as plasticity, wheat allows the producer to grow it in many regions of Russia, regardless of their soil and climatic indicators. The sown area occupied by wheat in Russia annually fluctuates within 29.5 million hectares. An important element in the used wheat agricultural technology is a cultivar. The purpose of our research was to assess the responsiveness of spring wheat cultivars to the environmental conditions of their cultivation and to identify the most adapted ones to the growing conditions. The studies were conducted in three ecologically different zones of Altai Krai: Priobskaya, Prialtaiskaya and Biysko-Chumyshskaya zones in 2019–2022. The objects of the studies were represented by spring wheat cultivars of three maturity groups: mid-early group — 6 cultivars; mid-ripening group — 11 cultivars; mid-late group — 5 cultivars. It was found that the "year" factor has the maximum influence on wheat in the formation of yield. The greatest responsiveness to vegetation conditions in the formation of yield was noted in the cultivars OmskGAU 90, Altayskaya 105, Tobolskaya, Altayskaya stepnaya, Altayskaya zhnitsa.

Keywords: wheat, cultivar, growing conditions, yield, grain, influence of factors, responsiveness.

Introduction

One of the leading grain crops in Russia is spring wheat. This is a strategic food crop of the country. The main goal of farmers is to produce wheat grain in a volume sufficient to ensure food and feed purposes of its use, with high quality indicators. Wheat also is the most common grain crop in the world community. By its nature, wheat is a grateful crop. Possessing such a property as flexibility, it allows the producer to grow it in many regions of Russia, regardless of their soil and climatic indicators. The main product obtained during the production of the crop is grain. Obtaining grain is one of the main tasks of producers in the agricultural sector of Russia [1, 2].

The area under wheat in Russia fluctuates annually within 29.5 million hectares. Thus, according to Rosstat, in 2022 the area under wheat was 29.57 million hectares; the volume of spring wheat from the figure was 43.5 %. In 2024, the area under the wheat in Russia was 28.5 million hectares [3].

Gross wheat harvests in Russia, according to Rosstat, in 2024 amounted to 82,419.3 thousand tons (Fig. 1). This is 11.2 % lower than the volume of wheat grain received compared to the 2023. According to the analytical assessment, the reduction in production volume occurred for two main reasons: a reduction in sown areas and a decrease in yield (https://ab-centre.ru/news/pshenica-ploschadi-sbory-i-urozhaynost-v-rossii-v-2024-godu) [3].

In order to ensure food security and the state of food independence of the Russian Federation, which guarantees full availability of food products to every citizen of the country in accordance with the requirements of rational consumption standards that provide a person with an active and healthy lifestyle, the Russian government has developed support measures and programs for the development of agricultural production.

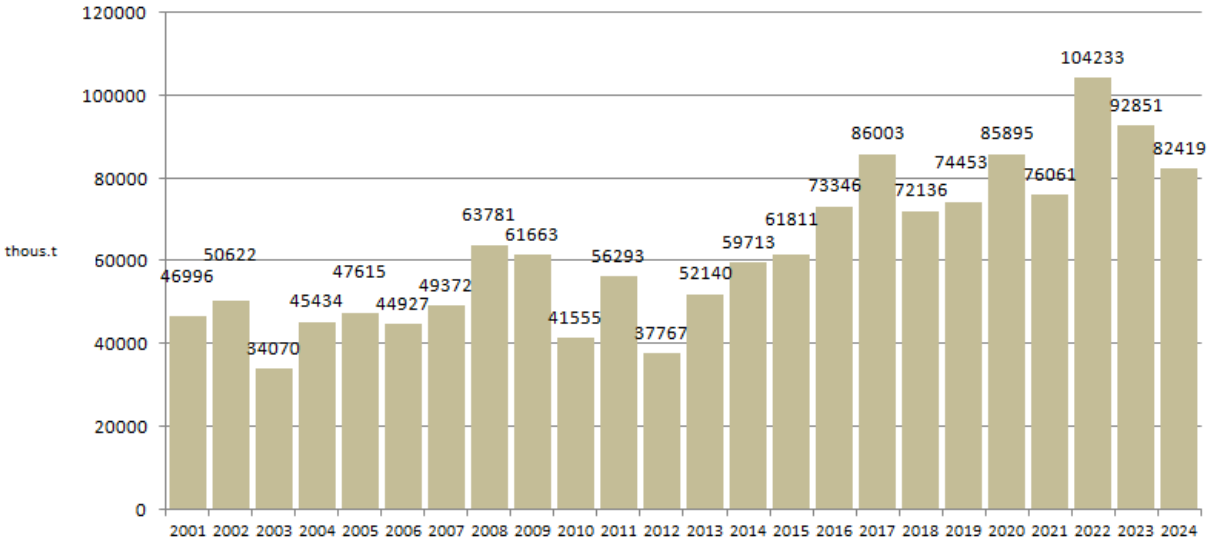

Figure 1. Gross wheat harvest in Russia in 2001–2024, thousand tons (source: Rosstat)

In 2016, Decree of the President of the Russian Federation No. 642 of December 1, 2016 was approved, which paid much attention to the transition of the country's agriculture to organic farming, which contributes to the production of environmentally friendly products that are safe for humans and the environment. In order to provide scientific and technical support for the development of agriculture and reduce technological risks in the food sector, the Federal Scientific and Technical Program for the Development of Agriculture for 2017–2030 was developed and approved [4]. This program — the Strategy for the Development of the Agro-Industrial and Fisheries Complexes of the Russian Federation for the Period up to 2030 is aimed at constant stable growth in food production. Over the past few years, a number of amendments have been made to the Program to clarify and update some of its acts: "Resolution of the Government of the Russian Federation of February 18, 2022 No. 205...", "Resolution of the Government of the Russian Federation of May 13, 2022 No. 872..." [5, 6]. The Order of the Government of the Russian Federation of September 8, 2022 No. 2567-r introduces amendments to the Strategy for the Development of the Agro-Industrial and Fisheries Complexes of the Russian Federation for the Period up to 2030, which will increase the level of food security of the Russian Federation through the use of modern domestic developments in selection, seed production, agricultural technology, the use of new means of protection, biological preparations [7].

Abiotic environmental factors affect the growth and development of the wheat, yield and quality of grain in many ways. The producers in turn control all negative phenomena, using various technological techniques that smooth or completely remove this effect [8–10].

The West Siberian region, including the Altai Krai, is included in the risky farming zone due to its soil and climate conditions. The soil and climate conditions of the Altai Krai are very diverse [11]. According to their indicators, the Altai Krai is divided into 7 zones. Soft spring wheat is demanding of environmental factors during its cultivation, therefore, for more effective work that gives a positive result, it is necessary to create conditions for the crop that contribute to obtaining a high result [12, 13]. One of such conditions is cultivars adapted specifically to the conditions of their cultivation, and competently selected zones: for breeding work, grain production and seed production of cultivars in which it is possible to obtain not only grain with good quality indicators in the current year, but also grain that will give a good harvest next year.

In this regard, there was a need to identify cultivars that genetically carry adaptability and stability to cultivation conditions, cultivation zones, climatic conditions, which would contribute to the identification of the necessary genotypes and the receipt of seeds with high quality indicators [14].

The purpose of our research is to assess the responsiveness of spring wheat cultivars to the environmental conditions of their cultivation and to identify the most adapted to growing conditions.

Experimental

The research was conducted in three ecologically different zones of Altai Krai: Priobskaya, Prialtaiskaya and Biysko-Chumyshskaya zones in 2019–2022. Weather conditions during the research period

varied significantly by year and on average by study zones. The most favorable conditions for the crop were in the Priobskaya zone, with a fairly optimal amount of precipitation and with the temperature indicators necessary for the crop. The objects of the research were spring wheat cultivars of three maturity groups: the mid-early group in the experiment is represented by 6 cultivars: Altayskaya 70 — standard, Altayskaya 99, Novosibirskaya 15, Novosibirskaya 29, Omskaya 36, PamyatiAziev; mid-ripening group 11 cultivars: Altayskaya 100 — standard, Altayskaya 110, Altayskaya 325, Altayskaya 530, Altayskaya 75, Altayskayazhnitsa, Altayskayastepnaya, OMGAU 90, Svetlanka, Sibirskyalians, Stepnayavolna; mid-late group — 5 cultivars: Altayskaya 105 — standard, Apasovka, Baganskaya 95, Omskaya 28, Tobolskaya.

To achieve the objectives and goals of the study, throughout the entire vegetation period of the crop, the necessary observations and records were carried out, based on the methodological guidelines [15, 16].

The area of the plot was 5 m^2. Replication was 4-times. Forecrop — grain crops. The seeding rate was 5 million germinating seeds / ha (500 pcs / m^2). Sowing was carried out by hand. Soil treatment was made in each zone according to the recommended technological parameters for the cultivation zone. Mathematical data processing was carried out using the dispersion analysis method according to the method of B.A. Dospekhov [17].

Results and Discussion

The main character of seed productivity of spring soft wheat is the yield. Modern technologies of cultivation of agricultural plants are based on high-yielding cultivars adapted to growing conditions. To create such cultivars, it is necessary, first of all, to select well-studied source material. As source material, it is possible to use samples from the Research Institute of Plant Growing collection, wild forms, samples from breeding institutions, cultivars with various characteristics that respond well to production conditions [18, 19].

Currently, the direction of replacing long-cultivated cultivars of agricultural crops with more modern, high-yielding cultivars with good adaptive properties is being promoted in production. Some authors note a negative relationship between the potential yield of a cultivar and its resistance to unfavorable abiotic factors of the cultivation environment [20]. Such a reaction of cultivars requires its study in different climate zones of cultivation and identification of the most favorable conditions for specific cultivars.

The results of our studies on the formation of yield by spring soft wheat cultivars of different maturity groups in three ecologically different zones and the data of three-factor variance analysis showed that the interaction of the factors “environment x year” has the maximum effect on the variability of the yield value of cultivars in all maturity groups: mid-early — 37.75 %, mid-ripening — 46.65 %, mid-late — 40.15 %. The second most influential factor affecting the variability of yield in mid-early and mid-ripening cultivars was the “year” factor — 36.24 % and 25.90 %, respectively, for mid-late cultivars — “environment” — 30.65 % (Fig. 2). The “cultivar” factor has an insignificant effect on the variation of the yield indicator, within 4 %, for all the studied cultivars. Thus, it was determined that the value of the “yield” trait and its variability are largely formed under the influence of the environment and conditions of the year of cultivation.

The data obtained as a result of observations and studies to determine the yield of the studied cultivars are presented in Tables 1–3.

In the group of mid-early cultivars, the highest average yield was obtained under the conditions of the Priobskaya zone (1.7 t/ha), the yield was 6 % lower in the Biysko-Chumyshskaya zone (1.6 t/ha) and 24.2 % lower in the Prialtaiskaya zone (1.3 t/ha) (Table 1). A high average yield in all study zones was obtained for the Omskaya 36 cultivar: 1.8 t/ha — Priobskaya zone, 1.6 t/ha — Biysko-Chumyshskaya, 1.4 t/ha — Prialtaiskaya.

Under the conditions of the Priobskaya zone, on average, over four years, no cultivar has reliably exceeded the standard cultivar — the Altayskaya 70 (1.7 t / ha). At the level of the standard cultivar were Omskaya 36 (1.8 t / ha), Pamyati Azieva (1.7 t / ha). All cultivars formed the maximum yield in 2020, the weather conditions of which (hydrothermal index = 1.02) were characterized as insufficiently moistened, but during the grain filling period it rained, which positively affected the formation of seeds. According to the reaction to vegetation conditions, the Altayskaya 70, Omskaya 36, Pamyati Azieva cultivars can be classified as extensive; the Novosibirskaya 15 and Novosibirskaya 29 cultivars can be classified as intensive.

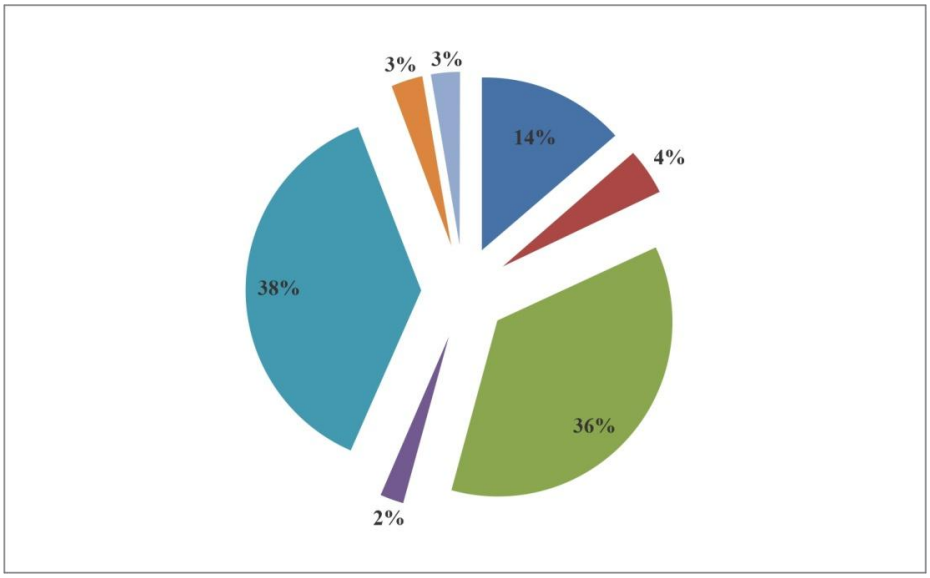

Figure 2. Results of three-factor analysis of variance for the "yield" factor of spring soft wheat cultivars, mid-early maturity group (2019–2022)

Under the Biysko-Chumyshskaya zone conditions, the average yield of Altayskaya 70 over the years of study was the highest (1.6 t/ha), no cultivar reliably exceeded this value. The cultivars Novosibirskaya 15 (1.6 t/ha), Novosibirskaya 29 (1.6 t/ha), Omskaya 36 (1.6 t/ha) were at the level of standard. The maximum yield of 2.7 t/ha was obtained from the Omskaya 36 cultivar in 2020.

Under the conditions of the Prialtaiskaya zone, on average, over four years, not a single cultivar reliably exceeded the yield level of the standard cultivar Altayskaya 70 (1.3 t/ha). The maximum average yield by year was obtained in 2019 — 1.7 t/ha, according to the hydrothermal index = 1.29, this year was considered to be quite humid.

Table 1

Mid-early maturity group cultivars yield in the study zones, t/ha

No.	Cultivar	Year				
		2019	2020	2021	2022	Mean
Priobskaya zone						
1	Altayskaya 70	1.4	1.8	2.1	1.7	1.7
2	Altayskaya 99	1.3	1.7	1.6	1.4	1.5
3	Novosibirskaya 15	1.3	1.7	1.9	1.4	1.6
4	Novosibirskaya 29	1.4	1.9	1.7	1.4	1.6
5	Omskaya 36	1.7	2.2	1.8	1.4	1.8
6	Pamyati Azieva	1.7	1.9	1.8	1.5	1.7
7	Mean	1.5	1.9	1.8	1.5	1.7
8	SEM_{05}	0.2	0.2	0.3	0.2	0.2
Biysko-Chumyshskaya zone						
9	Altayskaya 70	1.9	2.4	1.3	1.0	1.6
10	Altayskaya 99	1.5	2.2	0.9	0.8	1.3
11	Novosibirskaya 15	1.9	2.4	1.0	1.1	1.6
12	Novosibirskaya 29	1.9	2.5	1.2	1.0	1.6
13	Omskaya 36	1.9	2.7	1.2	0.8	1.6
14	Pamyati Azieva	1.7	2.4	1.1	0.9	1.5
15	Mean	1.8	2.4	1.1	0.9	1.6
16	SEM_{05}	0.3	0.1	0.2	0.2	0.5

Continuation of Table 1

No.	Cultivar	Year				
		2019	2020	2021	2022	Mean
Prialtaiskaya zone						
17	Altayskaya 70	1.8	1.2	1.0	1.1	1.3
18	Altayskaya 99	1.5	1.3	0.9	1.0	1.2
19	Novosibirskaya 15	1.6	1.0	1.1	0.8	1.1
20	Novosibirskaya 29	1.7	1.1	0.9	0.9	1.1
21	Omskaya 36	2.0	1.6	1.0	1.1	1.4
22	Pamyati Azieva	1.8	1.4	1.0	1.6	1.4
23	Mean	1.7	1.2	1.0	1.1	1.3
24	SEM_{05}	0.2	0.2	0.2	0.3	0.3

The average yield of mid-ripening cultivars varied both by zones and by years of study (Tab. 2). The maximum average yield of 1.9 t/ha was obtained under the conditions of the Priobskaya zone. In this zone, the average yield by cultivars varied from 1.7 t/ha (Altayskaya 530 cultivar) to 2.1 t/ha (OmGAU 90, Altayskaya Zhnitsa), the standard cultivar Altayskaya 100–1.9 t/ha. No cultivar reliably exceeded the standard in terms of "yield", but the yield of the following cultivars is at the standard level: OmGAU 90 (2.1 t/ha), Altayskaya zhnitsa (2.1 t/ha), Altayskaya stepnaya (2.0 t/ha), Altayskaya 75 (2.0 t/ha), these cultivars can be classified as neutral-type cultivars and used as genetic sources for creating high-yielding cultivars for the conditions of the Priobskaya zone.

Under the conditions of the Biysko-Chumyshskaya zone, all cultivars formed a high yield in 2020 (sufficient moisture year according to the hydrothermal index), the average indicator for the year is 2.4 t/ha. The Altayskaya stepnaya cultivar (2.7 t/ha) reliably exceeded the standard indicator (2.5 t/ha), and the Altayskaya zhnitsa and OmGAU 90 cultivars were at the standard level (2.6 t/ha). On average, over the years of research, the standard for the yield level (1.6 t/ha) exceeded all the studied cultivars. As genetic sources for the "yield" character the following cultivars can be taken: OmGAU 90, Sibirskyalians, Altayskaya 100, Altayskaya zhnitsa, Altayskaya stepnaya.

Under the conditions of the Prialtaiskaya zone, a high yield was obtained in 2019 (2.1 t / ha), the hydrothermal index of the year was 1.29, the year was quite humid. The Altayskaya zhnitsa cultivar (2.4 t/ha) reliably exceeded the standard for this character (2.1 t/ha). On average, over the years of research, the average yield was 1.3 t/ha. Neutral-type cultivars that show consistently high yields regardless of the conditions of the year include the OmGAU 90, Altayskaya zhnitsa, Altayskaya 100. These cultivars can be taken as genetic sources for the "yield" character for the conditions of the Prialtaiskaya zone.

Table 2

Mid-ripening maturity group cultivars yield in the study zones, t/ha

No.	Cultivar	Year				
		2019	2020	2021	2022	Mean
Priobskaya zone						
1	Altayskaya 100	1.6	2.2	2.3	1.7	1.9
2	Altayskaya 110	1.5	1.9	1.9	1.8	1.8
3	Altayskaya 325	1.5	2.0	2.0	1.7	1.8
4	Altayskaya 530	1.5	1.9	2.0	1.7	1.7
5	Altayskaya 75	1.8	2.3	2.1	1.8	2.0
6	Altayskaya zhnitsa	1.7	2.4	2.3	2.0	2.1
7	Altayskaya stepnaya	1.7	2.4	2.3	1.7	2.0
8	OmGAU 90	1.8	2.3	2.4	2.1	2.1
9	Svetlanka	1.5	2.0	2.3	1.7	1.9
10	Sibirskyalians	1.6	1.9	2.0	1.8	1.8
11	Stepnaya volna	1.7	2.2	2.0	2.0	2.0
12	Mean	1.6	2.1	2.1	1.8	1.9
13	SEM_{05}	0.2	0.2	0.4	0.3	0.2

Continuation of Table 2

No.	Cultivar	Year				
		2019	2020	2021	2022	Mean
Biysko-Chumyshskaya zone						
14	Altayskaya 100	2.0	2.5	0.8	1.1	1.6
15	Altayskaya 110	1.6	2.0	0.8	0.8	1.3
16	Altayskaya 325	2.1	2.2	0.9	0.8	1.5
17	Altayskaya 530	1.8	2.1	0.8	0.8	1.4
18	Altayskaya 75	2.2	2.4	0.8	0.9	1.6
19	Altayskaya zhnitsa	2.0	2.6	0.8	0.9	1.6
20	Altayskaya stepnaya	1.8	2.7	0.8	0.9	1.6
21	OmGAU 90	2.3	2.6	1.2	1.1	1.8
22	Svetlanka	1.5	2.5	0.8	0.8	1.4
23	Sibirskyalians	1.8	2.5	1.2	0.9	1.6
24	Stepnaya volna	1.7	2.4	1.0	0.8	1.5
25	Mean	1.9	2.4	0.9	0.9	1.5
26	SEM_{05}	0.3	0.2	0.2	0.2	0.5
Prialtaiskaya zone						
27	Altayskaya 100	2.1	1.3	1.1	1.1	1.4
28	Altayskaya 110	1.9	0.9	1.4	0.9	1.3
29	Altayskaya 325	2.1	1.0	0.9	0.9	1.2
30	Altayskaya 530	2.0	0.9	1.0	0.8	1.2
31	Altayskaya 75	2.1	0.8	1.0	0.9	1.2
32	Altayskaya zhnitsa	2.4	1.4	1.4	1.0	1.6
33	Altayskaya stepnaya	2.2	1.1	1.2	1.1	1.4
34	OmGAU 90	2.3	1.2	1.4	1.2	1.5
35	Svetlanka	2.0	1.1	1.0	1.1	1.3
36	Sibirskyalians	2.2	1.0	1.2	1.1	1.3
37	Stepnaya volna	2.1	1.0	1.3	1.0	1.3
38	Mean	2.1	1.1	1.2	1.0	1.3
39	SEM_{05}	0.3	0.2	0.4	0.3	0.4

Mid-late cultivars produce a fairly high yield under the conditions of the Priobskaya zone (Tab. 3). The minimum average yield was obtained in 2019 — 1.5 t/ha due to dry conditions in May–June, which negatively affected the initial stage of plant development. The average yield for all years of research was 2.0 t/ha. The Omskaya 28, Altayskaya 105, Tobolskaya cultivars showed a consistently high yield throughout the entire research period. These cultivars are of a neutral type, they can be taken as genetic sources in the selection process. Under the conditions of the Biysko-Chumyshskaya zone, the Tobolskaya cultivar showed the maximum yield in 2020 — 2.7 t/ha, it reliably exceeded the standard (2.4 t/ha). The average yield for 2019–2022 in the zone was 1.4 t/ha. The Altayskaya 105 and Tobolskaya cultivars can be used as the genetic sources. The yield of cultivars of mid-late maturity group under the conditions of the Prialtaiskaya zone was low and variable. The indicators varied from 0.7 t/ha (Apasovka cultivar, 2022) to 2.2 t/ha (Altayskaya 105 and Tobolskaya cultivars, 2019). The Altayskaya 105 and Tobolskaya cultivars can be used as genetic sources; in all years of research, they gave a consistently high yield for the zone.

Table 3

Mid-late maturity group cultivars yield in the study zones, t/ha

No.	Cultivar	Year				
		2019	2020	2021	2022	Mean
Priobskaya zone						
1	Altayskaya 105	1.6	2.4	2.1	1.9	2.0
2	Apasovka	1.4	2.4	2.4	2.1	2.1
3	Baganskaya 95	1.5	2.3	1.9	1.6	1.8
4	Omskaya 28	1.5	2.4	2.5	2.2	2.1
5	Tobolskaya	1.4	2.7	2.3	2.0	2.1

Continuation of Table 3

No.	Cultivar	Year				
		2019	2020	2021	2022	Mean
Priobskaya zone						
6	Mean	1.5	2.4	2.2	2.0	2.0
7	SEM_{05}	0.5	0.3	0.3	0.3	0.3
Biysko-Chumyshskaya zone						
8	Altayskaya 105	1.5	2.4	1.2	1.0	1.5
9	Apasovka	1.4	1.7	0.8	0.7	1.2
10	Baganskaya 95	1.5	2.2	1.0	0.9	1.4
11	Omskaya 28	1.4	2.1	1.0	0.8	1.3
12	Tobolskaya	1.7	2.7	1.0	1.0	1.6
13	Mean	1.5	2.2	1.0	0.9	1.4
14	SEM_{05}	0.4	0.3	0.1	0.2	0.4
Prialtaiskaya zone						
15	Altayskaya 105	2.2	1.1	1.2	0.8	1.4
16	Apasovka	1.9	0.8	1.2	0.7	1.2
17	Baganskaya 95	1.8	1.0	1.0	0.8	1.2
18	Omskaya 28	1.9	1.0	1.1	0.8	1.2
19	Tobolskaya	2.2	1.1	1.2	2.2	1.4
20	Mean	2.0	1.0	1.1	1.0	1.3
21	SEM_{05}	0.3	0.2	0.5	0.2	0.3

The variability of the influence of the conditions of the years of research, the conditions of the tests and their number have a large variability of the shares of their impact, such a dependence is noted by many authors [2, 8, 10, 12, 15]. In our studies, the share of the influence of the environmental factor "year" on the variability of the character "yield" was maximum in cultivars of all maturity groups (Table 4).

Table 4

The share of influence of factors in the formation of the "yield" character in spring soft wheat cultivars under the different environmental conditions, %

No.	Factor	Priobskaya zone	Biysko-Chumyshskaya zone	Prialtaiskaya zone
Mid-early cultivars				
1	Factor A (year)	43.8	91.1	62.3
2	Factor B (cultivar)	15.9	3.3	12.7
3	Interaction AxB	16.6	1.6	13.1
Mid-ripening cultivars				
4	Factor A (year)	48.7	89.6	79.2
5	Factor B (cultivar)	15.9	3.3	5.7
6	Interaction AxB	9.3	3.7	3.4
Mid-late cultivars				
7	Factor A (year)	72.1	82.9	58.1
8	Factor B (cultivar)	5.5	6.7	4.0
9	Interaction AxB	5.0	4.1	24.7

The maximum impact on the "yield" character was exerted by the "year" factor on mid-early cultivars (91.1 %) under the conditions of the Biysko-Chumyshskaya zone. Under the conditions of the Prialtaiskaya zone, the maximum share of the "year" factor's influence (79.2 %) was noted on mid-ripening cultivars. Under the conditions of the Priobskaya zone, the factor had the maximum influence on the yield of mid-late cultivars — 72.1 %. The share of the influence of the "year x cultivar" factor interaction was different for the groups and varied from 3.4 % (mid-ripening) to 24.65 % (mid-late). The "cultivar" factor had the strongest

(relative to the study zones) influence on the yield in the group of mid-early cultivars (12.7 %) under the conditions of the Prialtaiskaya zone.

Conclusions

The maximum influence on the formation of the yield of spring soft wheat cultivars of different maturity groups was exerted by the “year” factor and the conditions of the growing zone. Thus, the maximum influence on the “yield” character was exerted by the “year” factor on mid-early cultivars (91.1 %) under the conditions of the Biysko-Chumyshskaya zone. Under the conditions of the Prialtaiskaya zone, the “year” factor has the maximum influence on mid-ripening cultivars (79.2 %). Under the conditions of the Priobskaya zone, this factor has the maximum influence on the yield of mid-late cultivars — 72.1 %. The greatest responsiveness to vegetation conditions in the formation of yield was noted in the cultivars OmskGAU 90, Altayskaya 105, Tobolskaya, Altayskaya stepnaya, Altayskaya zhnitsa.

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Әр түрлі пісетін топтарда жаздық бидай сорттарын өсірудің экологиялық жағдайларына реакция

Бидай әлемдік ауыл шаруашылығында, соның ішінде Ресейде өсірілетін негізгі дәнді дақыл. Фермерлердің негізгі мақсаты — бидай дәнін азық-түлік пен жемшөп қажеттіліктерін қанағаттандыруға жеткілікті көлемде, жоғары сапалы көрсеткіштермен өндіру. Бейімделгіштік қасиетке ие бидай өндірушілерге оны топырақ пен климаттық жағдайларға қарамастан Ресейдің көптеген аймақтарында өсуіне мүмкіндік береді. Ресейдегі бидай алқабы жыл сайын 29,5 млн га дейін өзгереді. Бидайға қолданылатын агротехнологияның маңызды элементі сорт. Зерттеу жұмысының мақсаты жаздық бидай сорттарының қоршаған ортаны өсіру жағдайларына бейімділігін бағалау және өсіру жағдайларына неғұрлым бейімделгіштігін анықтау. Зерттеулер 2019-2022 жылдары Алтай аймағының үш экологиялық, атап айтсақ Приобской, Приалтайской және Бийско-Чумышской сияқты әр түрлі аймағында жүргізілді. Зерттеу нысандары жаздық бидайдың үш жетілу тобының сорттары болды: орта ерте топ — 6 сорт; орта маусымдық топ — 11 сорт; орта кеш топ — 5 сорт. Бидай өнімділігінің қалыптасуына «жыл» факторы ең үлкен әсер ететіні анықталды. Түсімнің қалыптасу кезінде вегетациялық жағдайларға ең жоғары сезімталдық «ОмГАУ 90», «Алтайская 105», «Тобольская», «Алтайская Степная», «Алтайская жница» сорттарында байқалды.

Кілт сөздер: бидай, сорт, өсу жағдайлары, өнімділік, астық, факторлардың әсері, сезімталдық.

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Реакция на экологические условия выращивания сортов яровой пшеницы разных групп спелости

Пшеница — основная зерновая культура, выращиваемая в мировом сельском хозяйстве, в том числе и в России. Основная цель фермеров — производство зерна пшеницы в объеме, достаточном для удовлетворения продовольственных и кормовых целей, с высокими качественными показателями. Обладая таким свойством, как пластичность, пшеница позволяет производителям выращивать ее во многих регионах России, независимо от почвенно-климатических условий. Посевная площадь, занимаемая пшеницей в России, ежегодно колеблется в пределах 29,5 млн. га. Важным элементом используемой агротехники пшеницы является сорт. Целью наших исследований была оценка отзывчивости сортов яровой пшеницы на экологические условия возделывания и выявление наиболее адаптированных к условиям выращивания. Исследования проводились в трех экологически различных зонах Алтайского края: Приобской, Приалтайской и Бийско-Чумышской зонах в 2019–2022 гг. Объекты исследований были сорта яровой пшеницы трех групп спелости: среднеранняя группа — 6 сортов; среднеспелая группа — 11 сортов; среднепоздняя группа — 5 сортов. Установлено, что фактор «год» оказывает максимальное влияние на формирование урожайности пшеницы. Наибольшая отзывчивость на условия вегетации при формировании урожая отмечена у сортов ОмГАУ 90, Алтайская 105, Тобольская, Алтайская степная, Алтайская жница.

Ключевые слова: пшеница, сорт, условия выращивания, урожайность, зерно, влияние факторов, отзывчивость.

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