«Уральский федеральный аграрный научно-исследовательский центр Уральского отделения Российской академии наук», 454902, г. Челябинск, ул. Гидрострой, 16, тел. 89000733128, e-mail: dergileva_tt@mail.ru.

Vasiliev A.A. – Doctor of Agricultural Sciences, Chief Researcher of the Department of Potato Growing of the South Ural Research Institute of Horticulture and Potato Growing - a branch of the Federal State Budgetary Scientific Institution "Ural Federal Agrarian Research Center of the Ural Branch of the Russian Academy of Sciences", 454902, Chelyabinsk, st. ... Gidrostroy, 16, tel. 89067705312, e-mail: kartofel_chel@mail.ru.

Dergileva T.T. – Senior Researcher of the Department of Potato Growing, South Ural Research Institute of Horticulture and Potato Growing - a branch of the Ural Federal Agrarian Research Center of the Ural Branch of the Russian Academy of Sciences, 454902, Chelyabinsk, st. Gidrostroy, 16, tel. 89000733128, e-mail: dergileva_tt@mail.ru.

Васильев А.А. – ауыл шаруашылығы ғылымдарының докторы, Оңтүстік Орал бау-бақша және картоп шаруашылығы ғылыми-зерттеу институтының картоп өсіру бөлімінің бас ғылыми қызметкері – РҒА Орал филиалының Орал федералдық аграрлық ғылыми орталығының филиалы, 454902, Челябинск қ.... Гидрострой, 16, тел. 89067705312, e-mail: kartofel_chel@mail.ru.

Дергилева Т.Т. – Оңтүстік Орал бау-бақша және картоп шаруашылығы ғылыми-зерттеу институты картоп өсіру бөлімінің аға ғылыми қызметкері – РҒА Орал филиалының Орал федералдық аграрлық ғылыми-зерттеу орталығының филиалы, 454902, Челябинск қ., көш. Гидрострой, 16, тел. 89000733128, e-mail: dergileva_tt@mail.ru.

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THE INFLUENCE OF VARIOUS AGRICULTURAL TECHNOLOGIES ON THE YIELD OF SPRING WHEAT IN THE CONDITIONS OF KOSTANAY REGION

Shvets S.S. – Master of Agricultural Sciences, Lecturer of Agronomy Department, NLC "A.Baitursynov Kostanay Regional University".

Shilov M.P. – Candidate of Agricultural Sciences, Associate Professor of Agronomy Department, NLC "A. Baitursynov Kostanay Regional University".

This article presents the results of a study of zonal, zero, minimum-zero, minimum and dump-flat-cutting technologies of wheat cultivation. The article presents average annual data from 2016 to 2020 for the analysis of wheat yield and calculation of the economic efficiency of the application of these technologies. The yield of wheat in our zone depends on properly selected agricultural machinery. As a result of the experiment, the best was the dump-flat-cut agricultural technology of wheat cultivation with an average yield of 16.5 centners per hectare and an increase of 0.9 centners per hectare to the control. The worst yield turned out to be on the variant with the use of zero technology – 12.7 centners per hectare. The calculation of economic efficiency showed that the most profitable was the moldboard-flat-cutting technology - 94.5%, the lowest profitability of 56.8% was shown by the zero agricultural technology.

Keywords: wheat, yield, agrotechnology, zero technology, dump-flat-cutting technology.

ВЛИЯНИЕ РАЗЛИЧНЫХ АГРОТЕХНОЛОГИЙ НА УРОЖАЙНОСТЬ ЯРОВОЙ ПШЕНИЦЫ В УСЛОВИЯХ КОСТАНАЙСКОЙ ОБЛАСТИ

Швец С.С. – магистр сельскохозяйственных наук, преподаватель кафедры агрономии, НАО «Костанайский региональный университет имени А. Байтурсынова».

Шилов М.П. – кандидат сельскохозяйственных наук, доцент кафедры агрономии, НАО «Костанайский региональный университет имени А. Байтурсынова».

В данной статье представлены результаты исследования зональной, нулевой, минимально-нулевой, минимальной и отвально-плоскорезной технологий возделывания пшеницы. В статье приведены среднемноголетние данные с 2016 по 2020 годы анализа урожайности пшеницы и расчет экономической эффективности применения данных технологий. Урожайность пшеницы в нашей зоне зависит от правильно подобранной агротехники. В результате опыта лучшей оказалась отвально-плоскорезная агротехнология возделывания пшеницы со средней урожайностью

16,5 ц/га и прибавкой к контролю 0,9 ц/га. Худшая урожайность оказалась на варианте с применением нулевой технологии – 12,7 ц/га. Расчет экономической эффективности показал, что наиболее рентабельной была отвально-плоскорезная технология – 94,5%, наименьшую рентабельность 56,8% показала нулевая агротехнология.

Ключевые слова: пшеница, урожайность, агротехнология, нулевая технология, отвально-плоскорезная технология.

ҚОСТАНАЙ ОБЛЫСЫ ЖАҒДАЙЫНДА ЖАЗДЫҚ БИДАЙДЫҢ ӨНІМДІЛІГІНЕ ТҮРЛІ АГРОТЕХНОЛОГИЯЛАРДЫҢ ӘСЕРІ

Швец С.С. – ауыл шаруашылығы ғылымдарының магистрі, "А. Байтұрсынов атындағы Қостанай өңірлік университеті" КеАҚ агрономия кафедрасының оқытушысы.

Шилов М.П. – ауыл шаруашылығы ғылымдарының кандидаты, агрономия кафедрасының доценті, "А. Байтұрсынов атындағы Қостанай өңірлік университеті" КеАҚ.

Бұл мақалада бидай өсірудің аймақтық, нөлдік, минималды-нөлдік, минималды және жер асты-жазықтық кесу технологияларын зерттеу нәтижелері келтірілген. Мақалада 2016 жылдан бастап 2020 жылға дейінгі бидайдың шығымдылығын талдаудың орташа көпжылдық деректері және осы технологияларды қолданудың экономикалық тиімділігін есептеу келтірілген.Біздің аймақтағы бидайдың өнімділігі дұрыс таңдалған ауылшаруашылық технологиясына байланысты. Тәжірибе нәтижесінде 16,5 ц/га орташа өнімділікпен және 0,9 ц/га бақылауға өсумен бидай өсірудің үйінді-жазықтық кесу агротехнологиясы үздік болды. Ең нашар өнімділік нөлдік технологияны қолдану нұсқасында болды-12,7 ц/га. Экономикалық тиімділікті есептеу көрсеткендей, ең тиімдісі-тегіс кесу технологиясы-94,5%, ең төменгі кірістілік-56,8% нөлдік агротехнология.

Түйінді сөздер: бидай, өнімділік, агротехнология, нөлдік технология, үйінді-жазықтық кесу технологиясы.

Introduction. Agrotechnology is a set of measures in crop production aimed at obtaining high and high-quality yields, using cost-effective methods that meet environmental standards. One of the main tasks for agricultural producers is the choice of agricultural technology. The purpose of this article is to study the effect of the use of various agricultural technologies on the yield of spring wheat crops.

To achieve the goal, the following tasks were set:

- determine the yield of wheat, depending on the technology of its cultivation;

-calculate the economic efficiency of the application of various agricultural technologies for the cultivation of wheat.

Research methodology. The research was carried out in the farm "Skindirov" in 2020. The farm is located in Kostanay district, Kostanay region, near the village of Sadchikovskoye. The farm is located in the arid steppe zone, on southern black soils.

The experiment was carried out in a four-field crop rotation: pure fallow - spring wheat 1 - spring wheat 2 - spring wheat 3. Wheat variety Lyubava 5 - medium early variety of common wheat

Experience scheme:

1 Traditional (zonal) technology (K);

2 Zero technology;

3 Minimum zero technology;

4 Minimum technology;

5 Moldboard-flat-cutting technology.

When processing the fields according to zonal agricultural technology, pure fallow was used in the first field. During the summer, four flat-cutting treatments were carried out at 10-12 cm, and at the end of fallowing on August 25, deep flat-cutting loosening by 25-27 cm with tools PG - 3.5 and KTS - 10-02. The anti-grain herbicide was applied when the economic threshold of harmfulness was reached.

The autumn tillage after the first wheat was harvested for the second crop consisted in shallow flat-cutting tillage by 10-12 cm. After the second wheat and the third wheat were harvested, the same technological operations were used. [2, p.88]

At zero treatment, chemical vapor was used in the first field. In the fallow field, two herbicide treatments were carried out with a continuous herbicide - Tornado. The first treatment was carried out between June 15 and 20, the second on July 25, a month later. [3, p.102]

For all subsequent crops in the crop rotation, there was a complete rejection of all treatments, only chemical pre-sowing and herbicide treatments were carried out in the crops of each crop. Presowing herbicidal treatment was carried out three days before sowing the culture. The anti-oat herbicide Cougar 0.4 l / ha was used in wheat crops.

The minimum-zero technology was carried out against the background of chemical steam, but mechanical presowing cultivation was carried out on all crops in the crop rotation.

The same herbicide Cougar was used in wheat crops against wild oats at the rate of 0.4 l / ha.

Minimum technology treatment consisted of the use of chemical steam, similar to the two previous technologies. Presowing cultivation was carried out for all crops in the crop rotation.

After the first wheat and the second wheat were harvested, autumn flat-cut loosening was carried out by 10-12 cm.

When processing using the moldboard-flat-cutting technology, the pure steam technology included shallow flat-cutting loosening to a depth of 10-12 cm with the KTS tool - 10-01 on May 30. On July 15, deep cultivated plowing (with a harvester) was carried out to a depth of 25-27 cm. Subsequent treatments during the summer consisted of two shallow cultivations of 10-12 cm. [4, p.92]

For all crops of crop rotation, moisture was closed in the early spring period and mechanical presowing cultivation was carried out.

All data obtained in the study were processed by the AgroStat program.

Research results. When cultivating wheat using different agricultural technologies, the yield may vary. Wheat yield was taken into account using the continuous accounting method. The results on wheat yield depending on the cultivation technology are shown in Table 1.

Table 1 – Long-term data on the impact of various agricultural technologies on the yield of spring wheat, 2016-2020

Cultivation technology	Productivity, *centners per hectare*			Average yield	
	Wheat 1	Wheat 2	Wheat 3	*centners per hectare*	%
1 Traditional (K)	18,2	15,4	13,2	15,6	100,0
2 Zero	17,2	12,0	9,0	12,7	81,4
3 Minimum zero	16,8	12,4	10,4	13,2	84,6
4 Minimum	17,0	13,8	11,8	14,2	91,0
5 Moldboard-flat-cutting	18,8	16,2	14,5	16,5	105,8
$LDS_{0,5}$	2,1	0,9	1,1		

The least significant difference (LDS) is a kind of division price, the resolution of the experiment in assessing the difference in sample means. The NDS criterion = $t_{0,5} * S_d$ indicates the marginal error for the difference between the two sample means.

If the actual difference is greater than $LDS_{0.5}$ (d ≥ NSR0.5), then it is significant, significant, with d ≤ $LDS_{0.5}$, it is insignificant.

Analysis of the yield by various cultivation technologies in the context of crops by crop rotation revealed a number of features. These features were the result of both different tillage technologies and the use of herbicides for individual crops. This conclusion is fully manifested when analyzing the yield for each crop separately. Thus, the yield of the first wheat did not fully reveal the differences between cultivation technologies. This is due to the fact that in the second half of the summer there was heavy rainfall, which practically equalized the conditions for the growth and development of the first culture. Therefore, its productivity was the same in all variants of the experiment – 17.0-18.8 centners per hectare. However, here, too, some peculiarities in the formation of the crop can be noted. So, its maximum value was typical for the moldboard-flat-cutting technology – 18.8 centners per hectare, followed by the traditional technology – 18.2 centners per hectare. This indicates that these technologies are good at clearing the field from common wild oats, improving the nitrogen regime of the soil and accumulating moisture in the soil. Zero, minimum-zero and minimum technologies are not inferior to these options in a wet year in terms of the yield of the first crop. However, a noticeable decrease in the productivity of the first crop should be noted. So, according to zero technology, this is a decrease, respectively, 1.0-1.6 centners per hectare, at a minimum-zero 1.4-2.0 centners per hectare, at a minimum 1.2-1.8 centners per hectare. These values are below the $LDS_{0.5}$ and can be considered insignificant. However, their high values at a high level of $LDS_{0.5}$ – 2.1 centners per hectare indicate the instability of these technologies.

In order to visually assess the effectiveness of various technologies of wheat cultivation, calculations of economic efficiency were carried out. For this, an assessment was made of the costs of processing fields using various agricultural technologies in the crops of spring wheat.

Table 2 – Average long-term data on the economic efficiency of various technologies for the cultivation of spring wheat in a four-field grain-fallow crop rotation, 2016-2020

Index	Cultivation technology				
	Traditional (K)	Zero	Minimum zero	Minimum	Moldboard-flat-cutting
1 Average yield, centners per hectare	15,6	12,7	13,2	14,2	16,5
2 Increase from 1 hectare, centners	-	-2,9	-2,4	-1,4	+0,9
3 Selling price of 1 centner, tenge	7000	7000	7000	7000	7000
4 Cost of production from 1 hectare, tenge	109200	88900	92400	99400	115500
5 Material and monetary costs per hectare, tenge	58750	56705	57058	57763	59384
6 Labor costs per 1 hectare, men per hour	6,20	5,50	5,54	5,60	6,27
7 Labor costs per hour, men per hour	0,39	0,43	0,42	0,40	0,38
8 Cost price of 1 centner, tenge	3766	4465	4322	4068	3599
9 Net profit per hectare, tenge	50450	32195	35342	41637	56116
10 Profitability,%	85,9	56,8	61,9	72,0	94,5

Costs per hectare for the control variant amounted to 58,750 tenge. Grain was sold at 7000 tenge per centner.

Based on the calculations, the least effective option was shown by the option using zero technology. The average yield for this option was 12.7 centners per hectare. The level of profitability was the lowest at 56.8%. Net profit per hectare is 32195 tenge, with the highest cost of one centner of grain – 4465 tenge, which is considered expensive grain compared to other options.

The best indicator of profitability of 94.5% and a yield of 16.5 c / ha turned out to be on the option with the use of moldboard-flat-cut tillage. Only in this variant is a positive increase in yield to the control – 0.9 centners per hectare. Considering that this option turned out to be the cheapest grain in terms of cost – 3599 tenge, the profit per hectare turned out to be the highest and amounted to 56116 tenge. The cost of production for this option was also the highest and amounted to 115,500 tenge. The cost of 1 centner of grain was 3599 tenge, which is 866 tenge less than in the worst case using zero technology.

The next most cost-effective option was the traditional technology option, which was the benchmark option. The profitability on this option was 85.9%, which is 29.1% more than the worst option. The cost of one centner of grain was 3766 tenge, which is only 167 tenge more expensive than the best option. Profit from 1 hectare amounted to 50450 tenge, which is less than 5666 tenge on the option with moldboard-flat-cutting technology, but more than on the option with zero technology by 18255 tenge.

The minimum technology yielded by 13.9% in terms of profitability to control and by 24.5% to the best option. The profitability on this option was 72.0%. The cost of 1 centner of grain was 4068 tenge. This can be explained by the cost of herbicides in the crops of the second and third wheat. Profit per hectare amounted to 41,637 tenge, which is 9,442 tenge higher than in the worst case. Based on this, we can say that the option using the minimum technology showed an average level of efficiency.

It is inferior to the above options, but still better than the zero-technology option, the zero-technology option. The level of profitability for this option was 61.9%. This is 32.6% less than the best option, but 5.1% better than the zero-tech option. Profit from one hectare was 35342 tenge, and the cost of one centner of grain was 4322, which is also considered an expensive grain. The high cost price was also formed due to the use of herbicides in all crop rotation fields.

Conclusions. Based on all of the above, we can conclude that the most economically profitable and expedient will be the use of moldboard-flat-cutting technology of wheat cultivation. The cost of 1 centner of

grain on this option is the lowest – 3599 tenge, and the net profit is the highest due to the highest yield – 41,637 tenge. The use of traditional technology will also be effective. The control option was not far behind in terms of performance from the best option and showed a profitability of 85.9%. The cost of grain for this option is slightly higher – 3766, which is a consequence of the need to use herbicides in the crops of the third wheat.

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Information about the authors

Shvets Saule Syrymbetovna – Master of Agricultural Sciences, lecturer of Agronomy Department of NLC " A. Baitursynov Kostanay Regional University", V. Dvurechenskiy Agricultural Institute, Kostanay st., Abay street, 28, tel. 87475123489, e-mail: saule.n.1997@gmail.com.

Shilov Mikhail Pavlovich – Candidate of Agricultural Sciences, Associate Professor of Agronomy Department, NLC " A. Baitursynov Kostanay Regional University", V. Dvurechenskiy Agricultural Institute, Kostanay st., Abay street, 28, e-mail: agrozenoz_1980@mail.ru.

Швец Сауле Сырымбетовна – магистр сельскохозяйственных наук, преподаватель кафедры агрономии НАО «Костанайский региональный университет имени А. Байтурсынова», Сельскохозяйственный институт имени В. Двуреченского, г. Костанай, улица Абая, 28, тел. 87475123489, e-mail: saule.n.1997@gmail.com.

Шилов Михаил Павлович – кандидат сельскохозяйственных наук, доцент кафедры агрономии НАО «Костанайский региональный университет имени А. Байтурсынова», Сельскохозяйственный институт имени В. Двуреченского,г. Костанай, улица Абая, 28, e-mail: agrozenoz_1980@mail.ru.

Швец Сауле Сырымбетовна – ауыл шаруашылығы ғылымдарының магистрі, "А. Байтұрсынов атындағы Қостанай Өңірлік университеті" КЕАҚ агрономия кафедрасының оқытушысы, В. Двуреченский атындағы ауыл шаруашылығы институты, Қостанай қ., Абай көшесі, 28, тел.: 87475123489, e-mail: saule.n.1997@gmail.com.

Шилов Михаил Павлович – ауыл шаруашылығы ғылымдарының кандидаты, "А. Байтұрсынов атындағы Қостанай Өңірлік университеті" КЕАҚ агрономия кафедрасының доценті, В. Двуреченский атындағы ауыл шаруашылығы институты, Қостанай қ., Абай көшесі, 28, e-mail: agrozenoz_1980@mail.ru.