# DEUTSCHE internationale Zeitschrift

für zeitgenössische Wissenschaft

№69

2023

DIZZW 2020

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ISSN (Print) 2701-8369
ISSN (Online) 2701-8377

**Deutsche internationale Zeitschrift für zeitgenössische Wissenschaft**

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**№69 2023**

**German International Journal of Modern Science**

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**№69 2023**

Deutsche internationale Zeitschrift für zeitgenössische Wissenschaft ist eine internationale Fachzeitschrift in deutscher, englischer und russischer Sprache.

Periodizität: 24 Ausgaben pro Jahr
Format - A4
Alle Artikel werden überprüft.
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# CONTENT

# AGRICULTURAL SCIENCES

## CROP YIELD OF WINTER BARLEY GRAIN WITH THE APPLICATION OF VARIOUS GROWING TECHNOLOGIES

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DOI: 10.5281/zenodo.10264456

**Abstract**

The experiment considered the influence of different methods of agricultural technologies on the yield of winter barley in the dependence of the investigated factors. Field experiments were carried out in the fields of the central experimental base of the Kashkadarya branch of the Research Institute of Grain and Legumes in the Karshi district of the Kashkadarya region under conditions of irrigated light gray soils. Stationary experience is represented by the following factors: the level of fertility (factor A); fertilizer system (factor B); plant protection system (factor C) and methods of basic soil cultivation (factor D). The relationship between the influence of the level of soil fertility, fertilizer rates, plant protection products, tillage system and yield, and crop structure of the promising winter barley variety Mavlono was determined. It has been established that (fertilizers, tillage, sowing method, means of protection) increases the yield of winter barley and positively affects the elements of the yield structure. The yield increase in comparison with the control changed from 10.4 to 26.8 c/ha. The statistical processing data show that the fertilizer system (35.8%) and soil cultivation (27%) had a certain influence on the number of productive stems; the fertilizer system (44.6%) influenced the spike size, the fertilizer system (28%) and the tillage (32.8%) had influence on the amount of grain in the spike and influenced the mass of grain from the spike.

**Keywords:** winter barley, monitoring, variety, yield, yield structure, regression.

**Introduction**

Currently, the world pays great attention to obtaining a high-quality and high yield in the cultivation of barley through the use of resource-saving technologies. As a result of improving the technology of barley cultivation, creating new varieties, as well as introducing them into production over the past 16 years, although the sown area has decreased, the volume of grain production has not changed due to increased yields.

Winter barley is a valuable grain fodder crop. In Central Asia, it is one of the most productive grain crops; its high potential yield is determined by the peculiarities of productivity formation [15]-[18].

High plasticity of plants, excellent nutritional qualities of grain and products of its processing create conditions for the wide distribution of this crop in the regions of Uzbekistan. With modern cultivation technology, the cost of winter barley is less in comparison with other grain crops. The potential of winter barley can be realized only by using the knowledge of its biological characteristics and ways to meet the requirements of the plant at various stages of growth and development [10] and [15].

To date, increasing the yield of winter barley grain and improving its quality is impossible without the use of modern growing technologies. The correct selection of a highly winter-hardy variety and the rational use of fertilizers are also determining factors in obtaining high and stable yields of this crop [16].

Cultivation of winter barley in crop rotation, in addition to yield, has a number of advantages. Ripening earlier than winter wheat and spring barley by 10-15 days, winter barley makes it possible to provide forage livestock breeding precisely at the time when there is a big shortage in it. Freeing fields early after harvest, winter barley is a good forage crop precursor. It is also important that in early spring, starting to grow and continuing to bush, winter barley suppresses weeds better than other crops, thereby eliminating the need for expensive herbicides, reducing production costs. This is what explains its lowest cost in the conditions of irrigated lands of the Kashkadarya region.

Kashkadar is one of the leading regions for the production of winter wheat and winter barley [3]-[5].

In the process of using soils in agriculture, their degradation occurs, which leads to a decrease in the productivity of field crops, including winter crops [9]. The main task is to develop agricultural practices that allow maintaining and increasing soil fertility and increasing crop productivity [2] and [16]-[18].

The optimal fertilizer system is not only a reduction in their application rates, but also a more efficient use of material costs [5] and [6].

A feature of winter crops, which determine their place in the crop rotation, is the reaction to changes in the agricultural background. Considering that among cereal crops, winter barley is demanding on soil fertility, therefore, a low agrobackground is the reason for the decrease, and the optimal one contributes to an increase in grain yield [11], [12], [17] and [18].

The difficult economic situation in agricultural production dictates the search for ways to reduce costs and more efficient use of available resources. One of the directions in solving this problem is the adaptation of existing technologies to specific production conditions, taking into account the characteristics of plant growth and development in each soil-climatic zone.

Technology is the main link in the production process. In the conditions of new production relations in agriculture, they play an important role. It is necessary to use it not only intensively, but also reasonably, and this can be done only by improving the technologies for growing crops [5].

This problem is caused by an increase in the cost of energy, agricultural machinery, plant protection products, and fertilizers. The volumes of these costs increase significantly with the intensification of technologies [8].

Therefore, the use of fertilizers, new equipment and technologies, the introduction of new varieties should be economically profitable and energetically expedient (Prudnikov,2013). To develop more advanced energy-saving technologies and taking into account the effectiveness of innovations in grain production, a comprehensive assessment is important, taking into account agronomic, economic and energy efficiency [8], [13] and [14].

An increase in the stability of the production of high-quality winter wheat grain largely depends on the creation of highly productive, high-quality varieties that are maximally adapted for economic cultivation zones [13] and [16]-[18].

**Materials And Methods.** The studies were carried out in a typical crop rotation for the zone with the following alternation of crops: cotton, winter barley. Stationary multifactor experience is represented by the following factors: the level of fertility (factor A); fertilizer system (factor B); plant protection system (factor C) and methods of basic tillage (factor D). The level of fertility (factor A) was created at the beginning of the experiment in 2000 (the 1st rotation of the crop rotation) and in 2008 (the second rotation of the crop rotation) by sequentially applying increasing doses of organic fertilizers (semi- decomposed cattle manure) and phosphorus based on existing standard indicators for soil fertility, application to the soil at: A1-100 kg/ha P90K60 and 100 t/ha bedding manure; at A2 - the doses are doubled; at A3 - triple.

**Experiment scheme**

| Variants | Fertility level (A) | Fertilizer system (B) | Plant protection system (C) |
|---|---|---|---|
| I | original fertility background ($A_1$) | without fertilizer ($B_1$) | without plant protection products ($C_1$) |
| II | average fertility background (100 t/ha of manure + 100 kg/ha $P_{90}K_{60}$; $A_2$) | minimum dose ($N_{60}$ at the resumption of spring vegetation; $B_2$) | biological plant protection system (biological products; $C_2$) |
| III | increased fertility background (200 t/ha of manure + 200 kg/ha $P_{90}K_{60}$; $A_3$) | average dose ($N_{120}$ at the resumption of spring vegetation; $B_3$) | chemical plant protection system against weeds ($C_3$) |
| IV | high fertility background (300 t/ha of manure + 300 kg/ha $P_{90}K_{60}$; $A_4$) | high dose ($N_{180}$ at the resumption of spring vegetation; $B_4$) | integrated plant protection system against weeds, pests and diseases ($C_4$) |

Fertilizer dosage ranges are determined based on the balance method and the required product quality. The average dose of fertilizers (B3) is based on recommendations for the use of fertilizers in the Kashkadarya economic region. The minimum dose (B2) is twice as low and the high dose (B4) is twice as high as the average dose of fertilizers.

In the experimental scheme, a special indexing of options is adopted, where the first digit is the level of fertility, the second is the fertilizer system, and the third is the plant protection system. Basic cultivation technologies are conditionally designated: I - extensive; II - pesticide-free; III - environmentally acceptable; IV - intensive.

The main indicator of the effectiveness of the studied agricultural practices is the yield of cultivated plants. The better the needs for the irreplaceable factors of plant life (heat, light, moisture, and mineral nutrients) are saturated and the better they adapt to specific prevailing weather conditions, the higher the productivity and the better the quality of agricultural crops [7] and [10].

**Results.** During the research period, changes in grain productivity according to the experience on plowing amounted to 28.4-53.7 centners per hectare, with an average yield of 43.4 c/ha (Table 1).

Consistent improvement in soil fertility levels and fertilizer doses increased crop productivity. In the variant with an increased level of soil fertility during plowing, when sprayed with biological protection against diseases and pests and the lowest rate of fertilizers (II), an increase in yield of 16.0 c/ha (15%) was obtained compared to the control variant. Improving the level of soil fertility, the use of an increased rate of fertilizers and spraying crops with herbicides (III) increased productivity by 20.8 c/ha (28%). The use of a 3 times higher rate of fertilizers with a high background of fertility and an integrated system of plant protection against weeds, pests and diseases (IV) led to an increase in grain yield of 24.8 c/ha (40%).

Table 1.

**Yield of winter barley depending on growing conditions, c/ha (2010-2012)**

| Soil fertility, fertilizer, plant protection | Year | | | Three year average | Yield increase compared to control | |
|---|---|---|---|---|---|---|
| | 2010 | 2011 | 2012 | | c/ha | % |
| I | 28,4 | 26,1 | 29,3 | 27,9 | - | - |
| II | 43,9 | 40,2 | 47,8 | 44,0 | 16,0 | 15 |
| III | 49,4 | 44,5 | 52,4 | 48,8 | 20,8 | 28 |
| IV | 53,1 | 52,4 | 53,7 | 53,1 | 24,8 | 40 |

The results of mathematical data processing and experience showed that the productivity of winter barley was influenced by the fertilizer system (31.5%) and the tillage system (38.3%). The close relationship between yield and cultivation technologies can be emphasized based on the value of the correlation coefficient, which is equal to 0.86 (Table 2).

Table 2

**Multiple regression dependence of winter barley grain yield on cultivation technology, 2010-2012**

| Index | Free term of the equation | Shares of influence and regression coefficients by factors | | | | $R^2$ |
|---|---|---|---|---|---|---|
| | | A | B | C | D | |
| Grain yield, c/ha | 27,84 | $\frac{4,0}{0,93}$ | $\frac{31,5}{7,56}$ | $\frac{13,1}{3,93}$ | $\frac{38,3}{12,13}$ | 0,89 |

Note: A - soil fertility, B - fertilizer system, C - crop protection system, D - tillage system. Above the line are shares of influence (%), below the line are regression coefficients.

The productivity of a particular variety depends on the growing area and environmental conditions and is formed under the most favorable growing conditions, as well as with optimal indicators of crop structure elements [15]-[18].

The main elements that determine the yield are the harvesting plant density, productive tillering, which determines the density of productive stems, and the mass of grain per ear. Productive tillering is highly dependent on the specific weather conditions of the year and on varietal characteristics. The low density of productive stems is not compensated based on the maximum productivity of each ear. The main condition for achieving a high yield is to obtain an optimal stem stand.

Analyzing the obtained data, it can be seen that the maximum indicator of the number of productive stems was noted in the variant using intensive technology for plowing and amounted to 539 pcs/m$^2$, which is 132 pcs/m$^2$ (32%) more than in control (I). The difference between pesticide-free (II) and environmentally acceptable technologies (III) and control was 80 pcs/m$^2$ (20%) and 122 pcs/m$^2$ (30%) (Table 3).

Table 3

**The structure of the harvest of winter barley, depending on the methods of its cultivation, (2010-2012)**

| Soil fertility, fertilizers, plant protection | Number of productive stems, pcs/m$^2$ | The number of productive spikelets in an ear, pcs. | Weight of 1000 grains, g | Grain weight from 1 ear, g |
|---|---|---|---|---|
| I | 249 | 30,4 | 32,3 | 1,08 |
| II | 315 | 35,2 | 36,1 | 1,30 |
| III | 376 | 35,5 | 37,3 | 1,31 |
| IV | 383 | 36,0 | 39,2 | 1,32 |

The number of grains in the ear, according to the variants of the experiment, varied from 30.4 pcs. on option I up to 36 pcs. on option IV with plowing. Such a number of grains contributed to obtaining the optimal yield of winter barley of the Mavlono variety. The weight of 1000 grains is the most important indicator of productivity, reflecting the amount of the substance contained in the grain, its size, and is considered an indicator of the quality of the seed material, which is taken into account when calculating the seeding rate, and largely determines germination and viability [15].

In general, this indicator varied by options from 32.3 g to 39.2 g. It can also be said that the improvement of technologies contributed to the increase in this indicator. The minimum values were noted on the control variant (I) as on plowing (32.3 g).

**Conclusion.** Consistent improvement of the level of soil fertility and doses of fertilizers increased the productivity of crops. Over the years of research, changes in productivity according to the experience on plowing amounted to 28.4 - 53.7 centners / ha, with an average yield of 43.4 centners / ha. On variants with direct sowing, the average value of this indicator was 25.1 c/ha, which is 32% lower compared to plowing, and these changes are mathematically significant.

Statistical processing data show that the number of productive stems was influenced by the fertilizer system (35.8%), and tillage (27%); on the head size - fertilizer system (44.6%), on the number of grains per ear

- fertilizer system (28%), tillage (32.8%, which also influenced the mass of grain with an ear (22% and 47%) and biological yield (32.9% and 41.5%).

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